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The OIL WEEKLY

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FOR OIL AND GAS PRODUCTION AND PIPE LINE DIVISIONS

THE WEEK'S NEWS INTERPRETED

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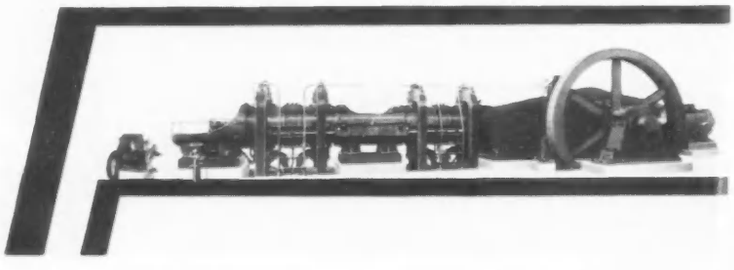

The OIL WEEKLY. Issued weekly by the Gulf Publishing Co., 3301 Buffalo Drive, Houston, Texas. Subscription price $1.00 per year; 15 cents per copy. Entered as second-class mail matter December 23, 1916, at the post office at Houston, Texas, under act of March 3, 1879.

OCT 16 1934

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THE OIL WEEKLY

ENGINEERING « STATISTICS » THE WEEK'S NEWS

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Contents • October 15, 1934

Volume 75 ◆ Number 5

NEWS OF THE WEEK:

A. I. M. E. Meets at Tulsa..... 6
Ickes Sees Attorney General..... 7
A. P. I. Program Announced..... 8
East Texas Violators Draw Fines..... 8

Personals 11
Production 51
Crude Prices 53
"Squeaks" 89

PRODUCTION ENGINEERING:

Efficiency of Flowing Wells..... 13
Variations in Reservoir Pressure in East Texas..... 24
Some Economic Aspects of Gas Solubility..... 30
Energy Relationships in Formations..... 38

FOREIGN TECHNOLOGY AND DEVELOPMENTS:

Increase in German Oil Production..... 47

MARKETS AND STATISTICS:

Market Disturbed and Slightly Up..... 49
Production for Week Sharply Up..... 51
Bureau August Report Still Favorable..... 52

FIELD REPORTS—

Oklahoma 58
California 77
Kansas 61
Texas 62
Louisiana 74
Michigan 76
Mountain 78
Wildcats 81

NEW EQUIPMENT 86

SPECIALIZED OIL JOURNALS
Published by
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BRANCH OFFICES

NEW YORK.....250 Park Ave.
PITTSBURGH.....Standard Life Bldg.
CHICAGO.....141 W. Jackson Blvd.
LOS ANGELES.....Haas Building
TULSA.....Hunt Bldg.
FORT WORTH.....W. T. Waggoner Bldg.
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Member Audit Bureau of Circulations.

Published every Monday. Single Copies 15 cents. Subscription price: domestic and foreign $1.00 a year. Entered as second-class mail matter December 23, 1916, at the post office at Houston, Texas, under act of March 3, 1879. Subscription restricted to those engaged in the producing and pipe line branches of the oil industry or the manufacturing and distribution of oil field supplies.

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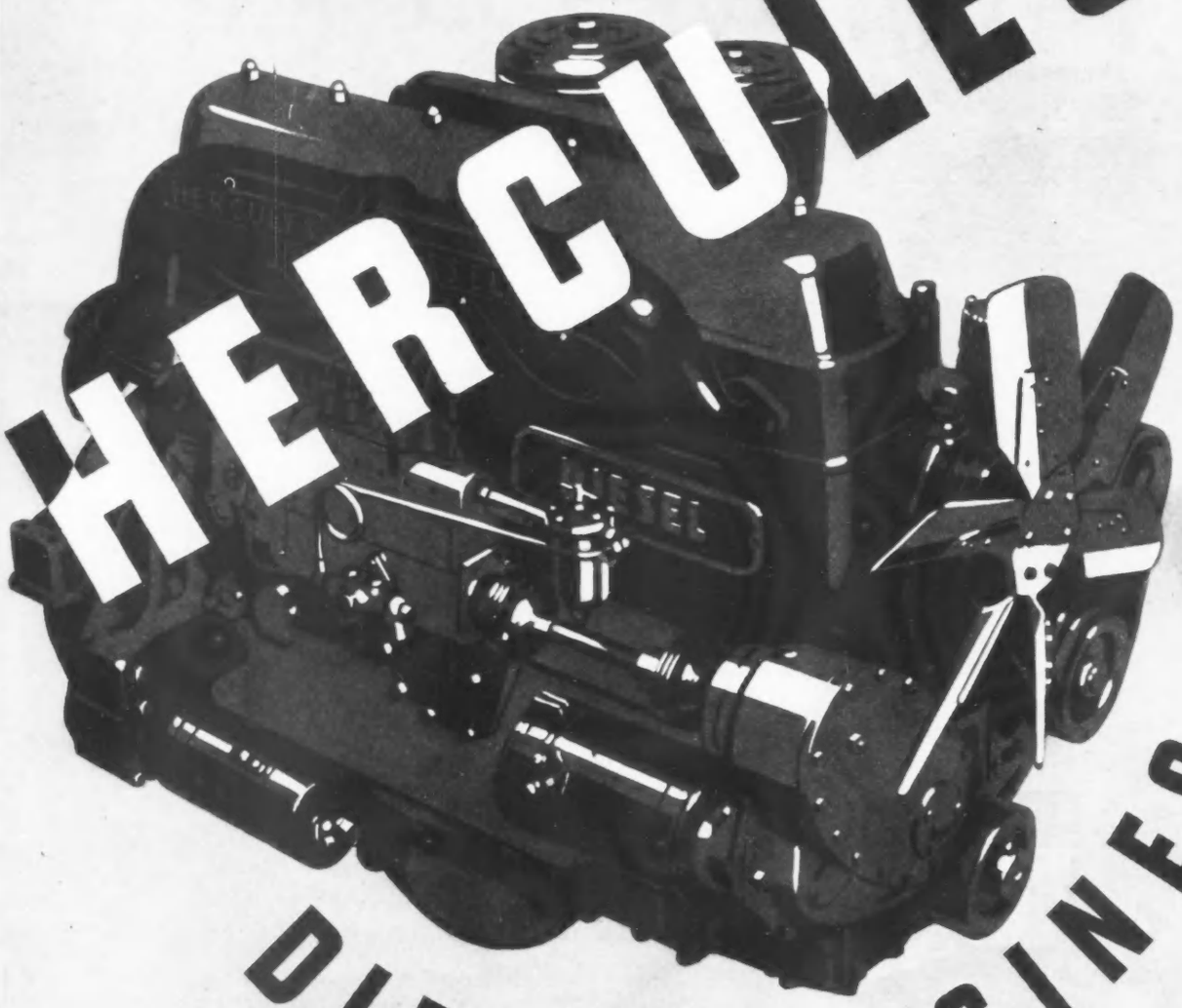

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VOLUME 75, No. 5

OCTOBER 15, 1934

THE OIL WEEKLY

FOR OIL AND GAS PRODUCTION AND
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ENGINEERING • NEWS • STATISTICS

The Changing Panorama

Some posted observers fear lower crude prices if the East Texas hot oil situation does not show an improvement. They are of the opinion that the industry can absorb 35,000 barrels daily of this type of production, but turn thumbs down on a hot oil production of 100,000 barrels and more in the East Texas district alone.

Opinion is divided as to the likelihood of stopping the bulk of the hot oil flow by government officials. The railroad commission may have the best opportunity with the tender rule, but this does not become effective until December 27. The government is apparently preparing to take more stringent action.

A few influential straight-shooting operators would like to see the East Texas field turned loose, their argument being that the resulting chaos would at least kill off the hot oil merchant, who is now profiting at the expense of the industry as a whole. Such a measure appears dangerous, however, since the East Texas field will produce a large flow of oil for a long time under open-flow conditions.

We are so definitely living in an "oil age" that temporary periods of distress must be followed by improved conditions. This thought should give us courage when in the midst of a serious over-production problem. If oil were not such a vital factor in the life and progress of the world, there might be cause for growing alarm. Many industries realize they have passed through their peak production periods and are definitely on the decline. Such industries are often forced to give way to newer and greater accomplishments.

The oil industry undoubtedly has not reached a peak production and consumption point, since new uses are more than offsetting losses to competing industries. The automobile continues to set the pace, and many parts of the world are showing heavy increases in oil consumption.

Some changes from the usual are evident in the plans announced for the annual meeting of the Institute at Dallas in November. The strong technical programs of the producing and refining departments are in usual evidence as are arrangements for business sessions of the marketers and the general business conferences of membership and directors. But beyond custom, local committees are arranging entertainment features that will enliven the hours between working sessions. An innovation is use of two hotels both for business sessions and entertainment. Even the annual dinner will be divided into two sections. Dallas oil men are spreading themselves to show hospitality and it is to be anticipated that this session will draw a capacity crowd.

THE OIL MAN'S CALENDAR

OCTOBER

16 *Mid-Continent Oil and Gas Association, Kansas-Oklahoma Division, Annual Membership Meeting.*

29 *American Gas Association, Atlantic City, New Jersey.*

NOVEMBER

2-5 *A. A. P. G., San Antonio Section, Annual Meeting and Field Trip, Laredo, Texas.*

12-15 *American Petroleum Institute, Dallas, Texas.*

13-14 *House Oil Investigating Committee Hearing, Dallas, Texas.*

22-23 *Road Oil Congress, Annual Meeting, Tulsa, Oklahoma.*

25 *House Oil Investigating Committee Hearing, Los Angeles, California.*

American Association of Petroleum Geologists (Pacific Section), Los Angeles.

DECEMBER

7-8 *Independent Petroleum Association of America, Annual Meeting, Fort Worth, Texas.*

A. I. M. E. Session *Reveals* *Progress in* Reservoir Research

Tulsa, Oct. 13.—Gas-oil relationships, fluid changes in crude oil reservoirs during production periods, and the economic application of engineering knowledge were the feature topics discussed by members of the Petroleum Division of the American Institute of Mining and Metallurgical Engineers gathered in annual meeting here on October 12 and 13. In the light of present conditions in the industry wherein production problems are closely interwoven with problems in economics, the meeting stands out as a high point among the technical gatherings of the past few years.

Beginning with the attempts of several years ago to obtain knowledge of solubility and other gas-oil relationships, when several investigators followed the plan of injecting gas into crude oils of known physical characteristics, down through the present work which involves the study of samples taken under formation conditions or conditions within the flow string, the fund of knowledge has gradually increased. This progress was made despite a lack of organization and under the handicap of a lack of sympathy from many executives. Investigators were sorely pressed at times for explanations as to how the data they were seeking could have an economic application. Although there remain many important unknowns, the day has arrived when students of reservoir conditions are contributing appreciably toward solution of the problem of producing oil efficiently and economically.

Papers presented during the first day, although not correlated, piece out the struggle for more knowledge and point out some of the accomplishments. One point which was stressed by several speakers was the desirability of applying engineering principles from the beginning of production in a new pool. For example the failure to apply known principles to the Oklahoma City pool from the beginning of its productive life has placed that area beyond the point of fullest application of beneficial principles. A second point of equal importance but one which was not quite so stressed is the need for legal revisions which would make possible the more efficient application of engineering principles.

Aside from the fact that much of the investigative work is now in the infant stage all of the papers were pointed along lines of economy, a trend certainly most favorable for the industry. All papers presented the first day were devoted to solubility, effect of gas liberation on crude oil properties, gas energy and energy relationships, and the economic aspects of these studies. It was pointed out that only by an intimate knowledge of the fundamental factors can the more advanced stages of the problem be attacked with intelligence. Through the application of data concerning reservoir conditions and the behavior of gas-oil mixtures under various conditions, more efficient flow strings may be designed, surface equipment may be more efficiently designed and used and operators may enable themselves to look farther into the ever-changing picture presented by the industry.

The Saturday morning session was devoted to the presentation of five papers dealing with gas lift and its relation to restricted production, estimation of reserves under proration, theories of water-coning phenomena, developments in the manufacture of sucker rods and a new multiple permeability apparatus. The second paper of this session, "Estimation of Petroleum Reserves in Prorated Fields," by E. V. Foran, Sidney Judson and W. A. Shaffer, Jr., brought about one of the most lively discussions of the meeting. In view of the difference in restriction methods applied to the various flush pools this problem is one which has not yielded readily to solution. Methods which had been followed for many years and which had been applied with a reasonable degree

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of satisfaction were in most instances entirely overthrown, leaving the industry with no general means by which it could predict its probable future through analysis of known reserves. The Oklahoma City pool again furnishes perhaps the outstanding example of the difficulty with which valuation engineers were faced. Several radically different methods of restriction have been applied to this pool with the result that ordinary decline curves reveal nothing of value.

A second important consideration of this portion of the meeting was the discussion of water-coning phenomena by R. D. Wyckoff and M. Muskat, Gulf Research Corporation. Too rapid production of wells close to either bottom or edge water may result in water-coning or the pulling of the oil-water contract around the well far above the common level and thereby forming a water barrier against the further movement of oil into the hole. In dense formations or formations of average porisity the formation of a water cone usually has meant abandonment of wells long before the average economic life of the field. There are, however, known instances where water cones have been depressed in formations of high porosity.

Although on Saturday afternoon the session functioned in competition with an inter-sectional football contest, the meeting was well attended. The recent trend toward deeper drilling has injected many problems not heretofore encountered. One of these problems in care of the hole by the use of proper drilling fluids so that long casing strings may be properly run and cemented. Experiences with tests below 10,000 feet show that equipment is strong enough for even greater depths, leaving the paramount problem of getting equipment into the hole. The session was devoted to mud and cementing practice in running casing in deep wells, chemical treatment of muds and a study of the chemical and physical properties of muds.

Activities of the first day of the meeting were terminated with the annual dinner over which H. D. Wilde, Jr., chairman of the Petroleum Division presided. Howard N. Eavenson, president of the American Institute of Mining and Metallurgical Engineers, Secretary A. B. Parsons; and W. B. Z. German, chief counsel for Skelly Oil Company, were the principal speakers.

Ickes Confers *About Enforcement With Head of* Legal Department

Washington.—Spurred by reports of a heavy increase in hot oil production in East Texas and by the open skepticism which greeted the announcement of the Planning and Coordination Committee that it would resume its stabilization program for "distress" gasoline only if, among other things, the government demonstrated its ability to cope with the problem by October 25, Oil Administrator Harold L. Ickes and a large group of oil administration officials conferred at length with Attorney General Cummings October 11.

Among those accompanying Administrator Ickes to the Department of Justice was Ralph Horween of Chicago, just sworn in as executive assistant to the administrator. Mr. Horween for some time had been chief of the administration's Chicago office, and in his new capacity will act as personal representative of the administrator in coordinating the activities of the Petroleum Administrative Board, the Petroleum Labor Policy Board and the oil enforcement unit of the Division of Investigations.

During the conference with the Attorney General a mass of material gathered by Louis R. Glavis, chief investigator; Charles Fahy, vice chairman of the Petroleum Administrative Board, and James H. Marshall, board member, during their recent investigation in Texas, was presented and possibilities of immediate prosecution were discussed.

"They think they have sufficient evidence for some good cases," Administrator Ickes said, "and I hope prosecutions will materialize at once."

Latest reports, it was said, indicate that hot oil is being run out of Texas at the rate of 125,000 barrels a day. The evidence which the administrator's investigators have uncovered, it was declared, deals with production violations occurring since September 27.

Need for prompt action by the enforcement agencies of the government to suppress illegal production is seen in the threatened demoralization of the oil price structure. A cut of two cents per gallon in the retail gasoline price, general along the Atlantic seaboard, is viewed as a forerunner of lower crude prices. It being declared in well-informed quarters that a cut of as much as 30 percent may be expected.

Unloading of Alleged Hot Gasoline Prevented

Washington.—Two tankers loaded with gasoline allegedly made from hot oil from the East Texas field have been prevented from unloading their cargoes along the New Jersey coast by the combined drive of the Oil Administration and the Department of Justice. The tankers are the Pueblo and the Phoenix.

The tanker Pueblo cleared from Texas City, Texas, September 27, but was prevented October 6 from unloading its cargo of 45,570 barrels of gasoline at Carteret, New Jersey, when United States District Judge Sorman in the court at Trenton, New Jersey, granted a temporary restraining order to prevent unloading the challenged cargo.

Oil Administrator Harold L. Ickes announced that a part of the Pueblo's cargo was believed to have been manufactured from oil produced in violation of state and federal regulations. The tanker's progress was followed through reports furnished the oil administrator by the navy, coast guard and other agencies.

The tanker Phoenix, carrying a cargo of 76,363 barrels of gasoline, left Texas City, Texas, September 30. The tanker was prevented from unloading at Bayonne, New Jersey, October 8, when United States District Judge Phillip Forman at Trenton, New Jersey, issued a temporary restraining order at the request of Oil Administrator Harold L. Ickes.

East Texas Violators Fined by Visiting Judge

Longview, Texas.—Heavy fines assessed against a group of East Texas refiners alleged to be persistent violators in the past of proration rules of the Texas Railroad Commission by District Judge C. G. Dibrell, Galveston jurist assigned to try a crowded docket prepared in recent weeks by the Attorney General's reorganized department, has injected fear, temporarily at least, into the ranks of those engaged in illicit operations.

George L. Culver, Gladewater producer and refiner, was found guilty October 8 and fined a total of $6000 for operating a by-pass on a crude gathering system in order to deliver illegal production to his Gladewater plant. The complaint charged that the by-pass was used on eight separate days last March. Shortly after being detected making use of the by-pass, Culver launched a court attack on the validity of the House Bill 99, empowering the commission with the right to inspect tanks and records of refiners, and was

(Continued on page 48)

Institute *Announces Program For Fifteenth* Annual Meeting

CONTROL of industrial activities, future federal legislation affecting the petroleum industry, technical developments, marketing possibilities, and taxation are featured subjects on the program of the 15th annual meeting of the American Petroleum Institute to be held November 13 to 15 at Dallas, Texas.

The preliminary program, as announced by the petroleum industry's largest national trade association, indicates that Secretary of the Interior Harold L. Ickes, who is also the Federal Oil Administrator, has been invited to speak on subjects related to federal legislation and control.

Further interest in federal activities in industrial fields in seen in the scheduled address of Amos L. Beaty, former president of the Institute and now chairman of the Petroleum Planning and Coordination Committee under the NRA.

The Institute has gone to sources for information concerning taxation, having invited as a guest speaker C. C. Chapman, of Portland, Oregon, editor and publisher of the "Oregon Voter," and nationally known as the "father of the gasoline tax." Mr. Chapman was instrumental in the writing and enactment of the first state gasoline tax law, passed in Oregon in 1919, to finance highways.

While the program is more extensive in a social way than ever before, the oil fraternity of the city of Dallas and the State of Texas having taken over this phase and made arrangements for at least three banquets, 12 dinners, several luncheons, 15 sight-seeing tours, three golf tournaments, and a barbecue, the Institute is maintaining the reputation of its annual meeting as being a "working convention." Scheduled on the program are two general sessions, eight group sessions, 46 committee meetings, 40 addresses and technical papers, and the election of eight officers and 39 directors, as well as 75 divisional general committee members.

Committee meetings will begin Saturday, November 10, and continue intermittently throughout the meeting, with the entire day Monday given over to such group sessions. The first general session is scheduled for Tuesday afternoon, November 13. At this time the 39 vacancies on the board of directors will be filled by election, and awards will be made for outstanding achievement in accident prevention work within the industry during the past year.

At this general session President Axtell J. Byles will deliver the "President's Address," an annual feature. Other speakers will be William R. Boyd, executive vice president and chairman of the Petroleum Board of Review under the N.R.A.; Baird H. Markham, director of the American Petroleum Industries Committee, and Mr. Chapman, who will discuss the development of gasoline taxation as originally contemplated and as realized.

Group sessions will get under way Wednesday morning, November 14, with the Division of Production considering principles and factors in allocation of crude oil production within prorated pools, the Division of Refining discussing lubrication problems, and the Division of Marketing taking up various retailing problems.

Secretary Ickes and Chairman Beaty are scheduled to speak at the second general session Wednesday afternoon. On Wednesday evening the Dallas Chamber of Commerce will hold a banquet in honor of the Institute's board of directors, the governors of five Southwestern States, representatives of state oil commissions, and directors of the East Texas, South Texas, and West Texas Chambers of Commerce. Group sessions also will be held Wednesday evening.

Group sessions are to be resumed Thursday, November 15. The Division of Production will take up drilling and production practice at morning meetings, while the Division of Refining will consider technical problems. The Division of Marketing is to consider the relation of highways and markets, discussing particularly the development of low-cost roads and farm-to-market routes. Each division will elect members of divisional general committees during the day.

The board of councillors will be in session Monday to nominate candidates for election as members of the board of directors. The board of directors will have daily meetings. The American Petroleum Industries Committee will have a formal meeting Monday afternoon, and on Tuesday there will be an informal meeting of state Petroleum Industries Committee chairmen and secretaries.

The formal meeting program will close Thursday night with the annual dinner. This year the dinner will be in the form of two simultaneous banquets, one in the Adolphus Hotel and the other in the Baker Hotel. Nationally-known humorists and radio stars are on the entertainment program.

On Friday, November 16, those attending the meeting have been invited by the oil men and commercial organizations of Fairfield and Teague, in Freestone County, to participate in an old-fashioned country barbecue on the farm of Executive Vice President Boyd, near Teague. Mr. Boyd is a native of Fairfield, and was the first mayor of Teague.

Local arrangements at Dallas, which have been under way for many months, are in charge of several committees under the direction of a general committee headed by Captain J. F. Lucey. Offices have been established at 1311 Magnolia Building.

Committee arrangements have included not only taking over the entire space of the Adolphus and Baker Hotels for annual meeting headquarters and building a bridge across Commerce Street to connect the hotels, but also reservation of all the rooms in the two other largest hotels in the city. Special arrangements have been made for additional railway and highway service, the city's taxicab fleet is to be augmented by 250 cabs, and 75 trunk and private telephone lines are to be installed in the hotels, with provisions for special service on long distance calls. Arrangements have been made also for office space in convenient buildings near the hotel, where telephone and telegraphic service will be available to individual oil men and to groups and company representatives.

Twelve special dinners have been arranged by the Dallas oil fraternity for men active in the various phases of the industry—production, refining, marketing, engineering, legal, trade press, royalty, scouting and leasing, accounting, equipment, drilling, etc. Separate golf tournaments of producers, refiners, and marketers are to be held at the Brook Hollow Golf Club, Dallas Country Club, and Lakewood Country Club.

In order that visiting oil men may inspect southwestern oil fields, 15 tours have been arranged so that virtually every important southwestern field can be seen before or during the meeting.

The Institute will establish two registration and information desks this year, one in the lobby of the Adolphus Hotel, and the other on the mezzanine of the Baker Hotel. Press headquarters will be set up in Room 318 of the Baker Hotel. Division of Production headquarters will be in Room 316 of

the Baker Hotel. These offices will be open Monday, November 12, and maintained until the close of the meeting.

The general and production preliminary program follows:

Tuesday, November 13

Morning—Meeting of Board of Councillors. (To nominate candidates for election as members of board of directors.)

Afternoon—2:30 p.m. General Session.

Report of board of councillors and election of directors.

Presentation of Accident Prevention Certificate Awards.

"The President's Address," by Axtell J. Byles, president.

Address: W. R. Boyd, Jr., executive vice president.

Address: Baird H. Markham, director, American Petroleum Industries Committee.

Address: C. C. Chapman, editor, "The Oregon Voter."

Wednesday, November 14

Morning—9:00 a.m. Group Session, Division of Production.

Principles and Factors in Allocation of Production Within Prorated Pools (Sponsored by Central Committee on Drilling and Production Practice.)

This session will be a symposium devoted to a discussion of the relationship of various principles and factors affecting allocation programs in any prorated pool. The following subjects will be discussed with speakers to be announced later:

Acreage and Formation Thickness.

Permeability, Potential and Bottom-Hole Pressure.

Volumetric Withdrawal and Application of Factors to Allocation Plans.

Afternoon—2:30 p.m. General Session.

Address: Hon. Harold L. Ickes, U. S. Secretary of the Interior and Federal Oil Administrator, has been invited to speak.

Address: Amos L. Beaty, chairman, Planning and Coordination Committee.

Evening—8:00 p.m. Group Session, Division of Production.

Drilling and Production Practice (Sponsored by the Central Committee on Drilling and Production Practice).

Papers on the following subjects are being considered by the Program Committee for presentation:

Rig and Derrick Lighting.

Research Project No. 4—Source Beds of Petroleum in California, Wyoming, Oklahoma, and Texas.

Rehabilitation of Small Properties in California.

Overcoming Paraffin Troubles by Hydraulic Pumps in California.

Effect of Oil Meters at Trap Set-ups in Kettleman Hills.

Economic Factors in Handling Heavy Oils in California.

Hydraulics of Mud Fluid Travel Through Drill Pipe.

History, Development and Application of Full-Hole Tool Joints.

Thursday, November 15

Morning—9:00 a.m. Group Session, Division of Production.

Drilling and Production Practice. (Sponsored by the Central Committee on Drilling and Production Practice.)

Papers on the following subjects are being considered by the Program Committee for presentation:

Methods of Evaluating Service Rendered by Expendible Equipment.

Pressure Changes in East Texas Under Different Rates of Flow.

Research Project No. 37—Application of Thermodynamic Data to Production Problems.

Statistical Appraisal of Probabilities of Discovery by Wildcat.

Report of Division's Nominating Committee, by Chairman M. B. Sweeney, Sun Oil Company, and election of 20 members of Division of Production General Committee.

Afternoon—Under tentative plans, business sessions will end at noon, and afternoon will be devoted to divisional golf tournaments at Brook Hollow Golf, Dallas Country, and Lakewood Country Clubs.

Evening—8:00 P.M., Annual Dinner.

Two dinners will be held simultaneously in both hotels with programs in charge of Dallas local committees.

Friday, November 16

2:00 p.m. Barbecue at lodge on farm of Executive Vice President Boyd tendered by oil men and commercial organizations of Teague and Fairfield, Freestone County, in honor of Mr. Boyd.

Petroleum Division of Special Libraries Association

Los Angeles.—At a meeting of Special Libraries Association, a Petroleum Section was formed within their Science-Technology group. The intention of this section is: To bring in closer contact all librarians whose work deals with petroleum and its allied subjects; to make a Decimal Classification of Petroleum Subjects; to facilitate inter-library loans; to exchange duplicate material. Any librarian interested is requested to write Albert Althoff, Librarian, General Petroleum Corporation of California, 2525 East 37th Street, Los Angeles, California.

East Texas Code Cases Before Supreme Court

Washington, D. C.—Validity of provisions of the Industrial Recovery Act will be decided by the United States Supreme Court, which on October 8 consented to review decisions of the Fifth Circuit Court of Appeals on petition of Amazon Petroleum Corporation and Panama Refining Company.

In the Amazon case a number of producers in East Texas are named as petitioners in a suit charging the production orders of the Texas Railroad Commission to be illegal and for the purpose of curtailing production "to such an extent as to artificially create a market demand for petroleum and its by-products, the objective being the creation and maintenance of high prices."

The suit also attacked the oil code and the orders of Oil Administrator Harold L. Ickes, the former on the ground that the Industrial Recovery Act attempts to delegate the legislative power of Congress to the President, attempts to vest in the President the powers of a supreme dictator and is contrary to the Constitution.

In the Panama case the company, a refiner, and A. F. Anding, a producer, attack the validity of the recovery act and regulations of the oil administrator.

Texas Commission Revokes Pipe Line Permit

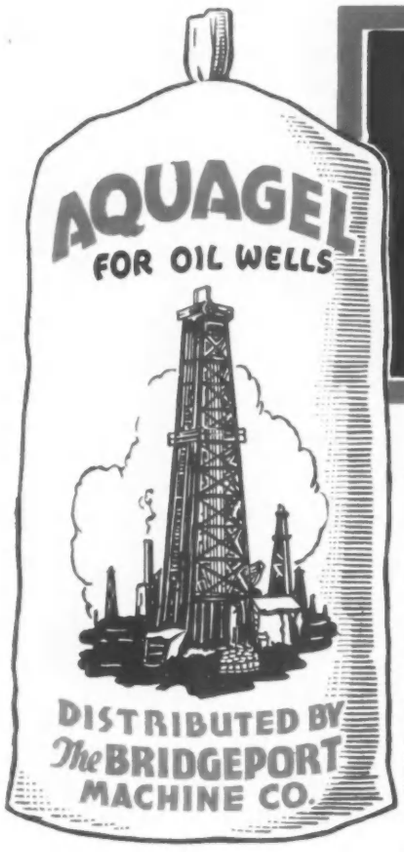
Austin, Texas.—The Texas Railroad Commission has extended its proration enforcement campaign during the past week to the revocation of pipe line connection permits on leases where operators have refused to report their production as required by commission regulations.

M. D. Heist Pipe Line Company, operating in Callahan County, was the first concern to which this plan was applied. Under Rule 36 of pipe line rules and regulations, the commission reserves the right to revoke the permit of any concern which refuses to follow the rules. The company gathered oil from wells on four leases and connected with The Texas Company trunk.

Olin Culberson, in charge of pipe lines for the commission, declared that this was only the initial step in a program that would be applied to the state generally.

For the past two months the commission has been requiring these reports, similar to those required from lines operating in the East Texas field and at Conroe. About 10 percent of the operators have failed to file reports as required.

Beginning with October 15, when the next reports are due, the rule will be invoked against every concern which fails to comply with the regulation.



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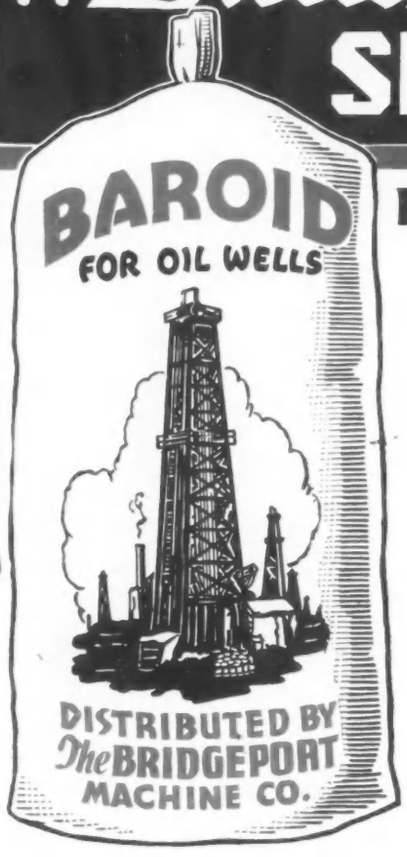

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MEN IN THE INDUSTRY'S NEWS

SENATOR MARTELLI, president of Azienda General Italiana Petroli, was expected to return to his office in Rome early in October, following an illness.

JOHN W. KLIMKIEWICZ, petroleum engineer with S. A. Pionier, Poland, recently was transferred to Truskawiec from Lwow.

G. MOSES KNEBEL, chief geologist of Standard Oil Company of Venezuela, has returned to headquarters after visiting with his wife and family, the World's Fair at Chicago.

JOHN G. NATION, superintendent for Standard Oil Company of Venezuela, has returned to Quirequire field after a vacation in the United States.

DR. WILLIAM S. HOFFMEISTER of Maracaibo, where he has served for many years as paleontologist for Lago Petroleum Corporation, has been transferred to Standard Oil Company of Venezuela's paleontological laboratory at Caripito, Venezuela.

J. Y. SNYDER of Shreveport, past president of the American Association of Petroleum Geologists, who was recently stricken ill at his office, has been taken to a sanitarium at Rochester, Minnesota.

JOSEPH B. ELAM, executive secretary of the Louisiana-Arkansas division of the Mid-Continent Oil and Gas Association, is convalescing at his home in Shreveport, after a recent illness.

BLAINE B. WESCOTT, chief of the division of metallurgy of the Gulf Research Corporation, Pittsburgh, spent a portion of the week in Houston and returned to Tulsa to attend the annual meeting of the Petroleum Division, American Institute of Mining and Metallurgical Engineers, October 12-13.

W. R. RAMSEY, president of Ramsey Petroleum Corporation, Oklahoma City, is recovering from an illness contracted on a recent trip to the Rocky Mountain area and California.

C. H. KOINM, general superintendent for Gas Service Company, Kansas City, Missouri, spent several days during the early part of the week in the fields of northeastern Oklahoma. Gas Service Company is a producing and marketing company and now holds the gas service franchise at Nowata, Oklahoma.

R. P. McLAUGHLIN, petroleum engineer, who was Oil & Gas Supervisor for the state of California the first term under the new law providing for such a position, has accepted the position of general manager of Burnham Exploration Company, Los Angeles.

JOHN W. FINCH, director of the United States Bureau of Mines, spent the early part of the week in his first visit to the Petroleum Experiment Station at Bartlesville, Oklahoma, bringing to a close a general inspection of the field forces. Dr. Finch, who was appointed to the directorship on August 28, 1934, succeeding Scott Turner, was formerly dean of engineering at the University of Idaho. He received his A.B. degree at Colgate in 1897 and his M.A. the following year from the same institution. From 1901 to 1904 he was state geologist for Colorado and from 1905 to 1916 a consulting geologist and mining engineer. During this period he spent considerable time in Africa and China in a study of the mineral resources.

DON R. KNOWLTON, chief production engineer for Phillips Petroleum Company, returned to his office on Monday, October 8, for the first time since a recent operation in a Kansas City hospital.

I. E. DUGAN, Oklahoma deputy proration umpire, has been transferred from headquarters at Oklahoma City to the Ada district where he will be in charge of proration affairs.

A. FRANK DABELL, who is now in England, recently retired from the management of Trinidad Petroleum Development Company, subsidiary of British Controlled Oilfields, Limited, Montreal and London. Mr. Dabell was well known in South Russia and Roumania, and had been in Trinidad since 1927. He was for many years a council member of the Institution of Petroleum Technologists.

N. A. McCORD, Foraker, Oklahoma, has applied for a passport to go to Aruba, Dutch West Indies, where he will reenter services of Standard Oil Company. He formerly spent several years in this district.

W. J. ARMSTRONG, Oklahoma state proration umpire, spent two days in Tulsa conferring with operators and obtaining intimate knowledge of the views being taken toward operating and proration plans.

H. A. SEAMARK, consulting field engineer to Anglo Persian Oil Company and inventor of the pressure controlled B.O.P. named after him, is on a business visit to Venezuela and Trinidad.

E. R. STANLEY and Harry P. Stolz, geologists and engineers, have removed their Los Angeles offices to 630 Security Building, 510 South Spring Street.

N. G. CUMMINGS, formerly purchasing agent of Vacuum Oil Company in Texas and Louisiana and later with the purchasing department of Magnolia Petroleum Company at Dallas following the merger between Standard Oil Company of New York and Vacuum Oil Company, has accepted a position as manager of Southwest Supply Company with offices in the Esperson Building at Houston.

H. R. GRUBER, Tulsa, vice president and sales manager, and M. G. Ensinger, vice president in charge of manufacturing of Union Wire Rope Company, are on a tour of Mexican oil fields.

HARRY H. "GYP" THOEMING, 51, scout in the northeastern Oklahoma division of Gypsy Oil Company, died at his home in Tulsa on Wednesday, October 10, following an illness of several weeks. He was born on July 1, 1883, at Davenport, Iowa, and entered the scouting department of Gypsy Oil Company in May, 1918. From that date until his illness he was continuously in the land and scouting departments and was in point of service the oldest employe in these departments. For the past eight years he has scouted the northeastern Oklahoma division where he was widely known and liked.

CHESTER H. BROWN, aged 66 years, who has been intimately connected with the oil industry in California for more than 35 years, died of a heart attack at his summer home at Balboa, October 5. He had been connected with Union Oil Company for many years, and retired three years ago as director of production and exploration, but remained on the board of directors. He served one year as president of the California Oil & Gas Association, took a prominent part in the councils of the oil industry in his home state, as well as nationally, and was prominent in civic affairs. He is survived by his widow, four daughters and one son.

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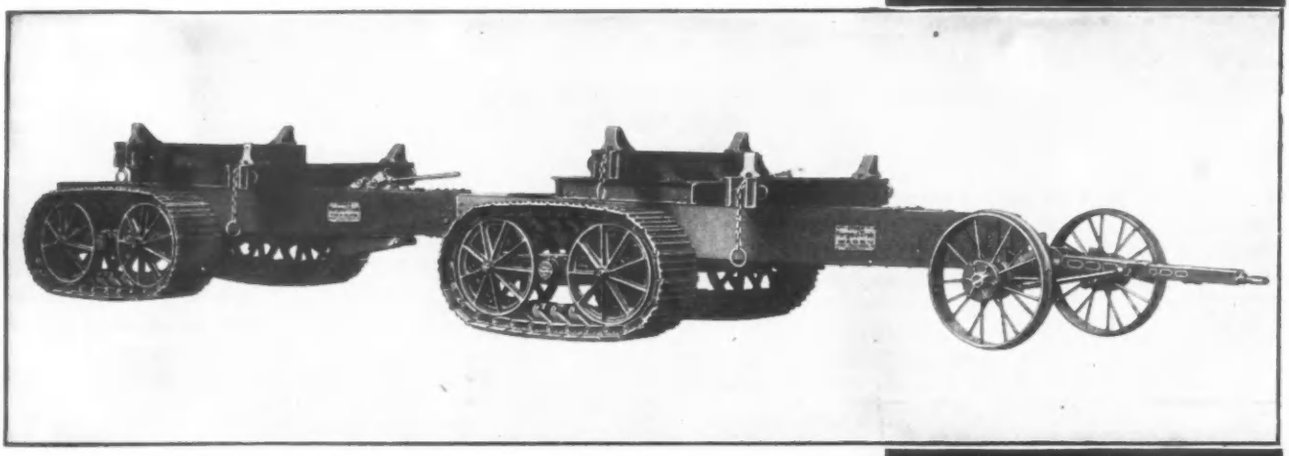

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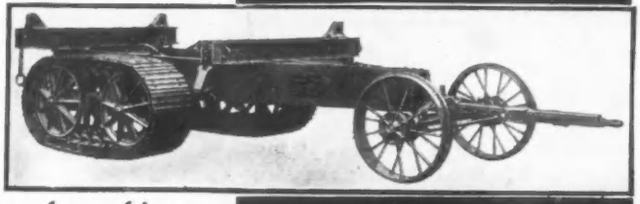

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Efficiency of Flowing Wells

Summarized Results and Calculations of an Investigation in the Masjid-i-Sulaiman Field by the Anglo-Persian Oil Company, Ltd.

CECIL J. MAY
Anglo Persian Oil Company

THE importance of a knowledge of the physical laws involved in the production of oil from a reservoir has come to be generally realized in recent years and it is therefore unnecessary to elaborate on the many problems which still await complete solution. Among them the vertical flow of mixtures of oil and gas has attracted considerable attention and a number of papers have appeared in the literature from time to time. The complete solution of the problem would cover such aspects of oil field technology as the calculation of bottom-hole pressures from purely surface data; the estimation of natural flowing lives; the design of gas-lifts and the selection of tubing for natural flow, and so on. It is still true, however, that the results so far published have not been particularly consistent and there are no generally accepted data available of universal applicability. It is, in fact, by no means easy to obtain a sufficiently wide range of variables under the operator's control to determine the laws of flow without ambiguity and much of the published research has been directed towards the solution of the specific problems of individual fields representing only a partial treatment of the whole subject. It was with a similar object that work was commenced on the Masjid-i-Sulaiman field of Anglo-Persian Oil Company towards the end of 1930 and has since continued as opportunity offered.

It is of course realized that the results obtained cannot necessarily be applied elsewhere without modification and, in some cases, considerable extension. At the same time conditions in this field are somewhat unusual in allowing certain aspects of the problem to be isolated and examined without the disturbing effects of a large number of independent or partially independent variables. For example, since the field is under unit control, it is possible to maintain steady conditions on any particular well over long periods. Moreover, the structure of the limestone reservoir is such that the gas-oil ratio for a given well is sensibly constant over very wide ranges of production rates, and in many cases that bottom-hole differential pressure is negligibly small even at rates of flow of 10,000 to 20,000 barrels or more per day. It is possible therefore to study experimentally, but on the full scale, flow in wells with a fluid of unvarying composition over the full range of production rates, and in many cases the bottom-perimental results, with a theoretical discussion, have already been published[1], but it is felt that a satisfactory solution of this simple form of the problem might be of value in correlating results obtained under more complicated conditions, and it is rather from this point of view that the present paper is written.

This paper was read before the Petroleum Division, American Institute of Mining and Metallurgical Engineers meeting at Tulsa, Oklahoma, October 12-13, 1934.

IN the paper by May and Laird (footnote 1), the general equation of flow was given in the form:

$$144\ v\,dp = dx + \frac{vw^2\,dv}{g\ A^2} + \frac{144\,(v-\rho)\,dp}{v\,\frac{w}{Ab}+1} + \frac{4kv^2w^2\,dx}{gDA^2}$$

where the various symbols have the following meanings:

dx = small increment in height in well, ft.
dp = corresponding small change in pressure, lb. per sq. in.
D = casing diameter, ft.
A = casing area, sq. ft.
w = weight of total fluid (i.e., oil + associated gas) passing through well per second, lb. per sec.
ρ = density of oil, lb. per cu. ft.
v = specific volume of total fluid at pressure under consideration, cu. ft. per lb.
b = velocity of slip between gas and oil.
k = friction factor.

From its method of derivation (of which limits of space do not permit the re-publication) this formula should be applicable to all conditions of flow, its numerical computation requiring a knowledge of the physical properties of the fluid and of two more or less arbitrary factors.

Effective Properties of Fluid

Implied in this formula are the properties of the fluid which are effective in determining flow. The important properties of the oil itself are the density, viscosity and surface tension, all of which increase as the pressure falls in the well and gas comes out of solution ([2,3]). Our results tend to show that this increase is unimportant as far as calculations on any one well are concerned, but it does not follow that oils of very different basic physical properties will behave in precisely the same way with regard for example to slippage.

The other important quantity is the gas-oil ratio. This as ordinarily measured is a combination of two factors: the gas actually held in solution in the oil under reservoir pressure, which we may term dissolved gas and free gas drawn into the well from the formation. In Masjid-i-Sulaiman we are fortunate in that we are rarely troubled with free gas and the problem therefore is very much simplified. Considering, for the moment, only dissolved gas, it has been pointed out that the value obtained for the gas-oil ratio depends upon the method adopted for its measurement; ([4,5]) on whether the gas is removed from solution in a single flash or in a number of stages. The discrepancy

[1]May and Laird: Jnl. Inst. Petr. Tech. (1934) 214.

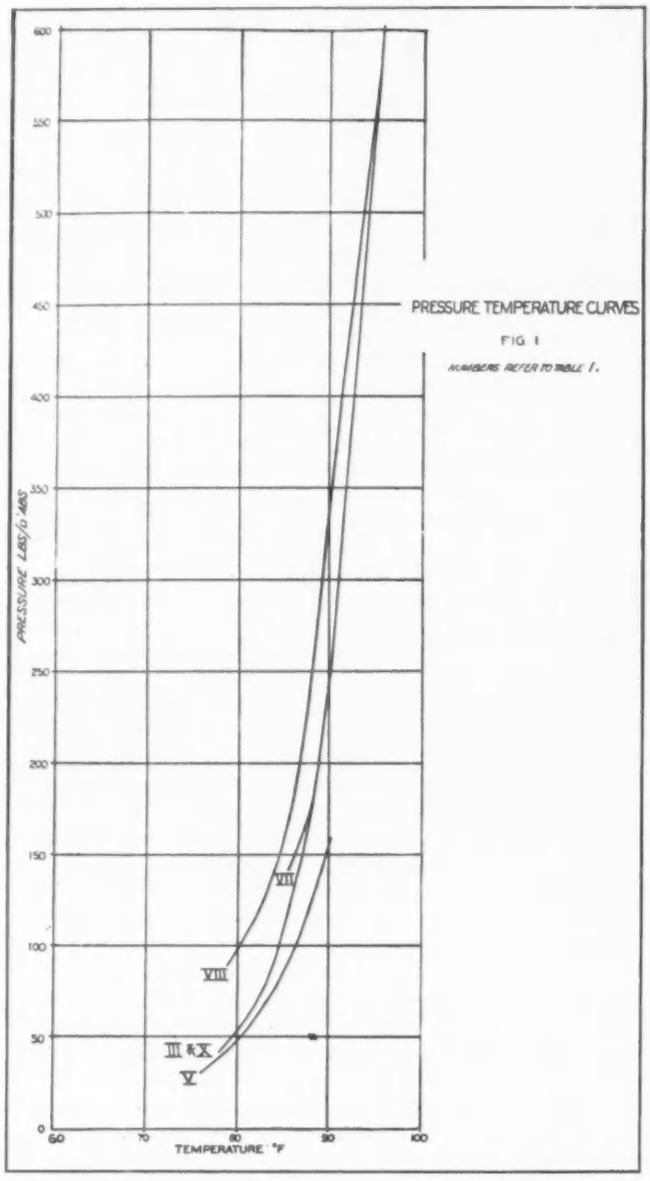


Figure 1—Pressure-Temperature curves. Numbers refer to Table 1.

is due, of course, to the fact that we are not in general dealing with a pure gas dissolved in a nonvolatile liquid, but with one of variable composition including the vapors of low-boiling liquid hydrocarbons. The temperature of separation and the attainment of true equilibrium also require close attention if accurate and repeatable values are to be obtained, so that ordinary field measurements cannot be expected to provide more than a rough approximation. A considerable amount of work has been carried out in Persia on this subject from a number of different points of view. We require, for example, to calculate the optimum number of stages and pressures of gas separation to retain the maximum amount of volatile liquid hydrocarbons in the residual crude.

From the point of view of reservoir control and the flow of wells the saturation pressure has been found of considerable value as an easily measured and unique property of a given reservoir crude. If a sample of oil is drawn from the bottom of a well, maintained at reservoir temperature, and the pressure slowly released, the saturation pressure is defined as that pressure at which gas is first evolved from solution. The use of this quantity avoids any ambiguity and considerably simplifies interpolation, as will be seen from the curves and nomograms given herewith. The saturation pressure varies from one point in the reservoir to another in a manner that has been discussed by Comins and Pym ([6],[7]) and to which space will not permit of further reference here. Once the law of distribution has been determined, however, it has been possible to consider very simply possible future variations.

The effect of free gas represents a difficult problem with which we have not had to deal. The obvious solution that suggests itself is that the pressure at which the oil produced will dissolve the whole of its associated gas should be employed as a nominal saturation pressure, and, for the purpose of discussion, this will be assumed in what follows.

Finally, it should be mentioned that in this work it is convenient to express gas-oil ratios in terms of the volume of gas associated with unit volume of oil rather than in some arbitrary unit such as cubic feet per barrel. Thus a 40.1 ratio is equivalent to 225 cu. ft. per barrel, or (for Persian crude) to a saturation pressure of about 460 pounds per square inch absolute.

Available Energy

If one attempts to calculate the energy available from the expansion of this associated gas with falling pressure from first principles considerable complications arise due to deviations from the simple gas laws. The necessary corrections are quite simply covered by the experimental method used in the work at present under discussion. (See also example 3). A sample of reservoir crude oil is drawn containing the whole of its dissolved gas under reservoir pressure ([8],[9]). The sample is held in a closed container over mercury and a pressure volume curve for the total oil + gas is determined experimentally by measuring the fall in pressure as known amounts of mercury are removed from the apparatus. In an actual flowing well the temperature falls from the bottom upwards and is not a unique function of the pressure. However, we have found it sufficiently accurate for most practical purposes to assume that it is and have determined a suitable average pressure-temperature curve for a well in Masjid-i-Sulaiman (Figure 1): In measuring our pressure-volume curves the temperature is adjusted to correspond to this average p-T curve. p-v curves are measured for a few samples of oil with different saturation pressures and interpolation between them is then a simple matter. In Figure 2 are shown a number of typical curves, v being expressed in the units cubic feet per pound of reservoir crude.

Now the energy available on expansion of a fluid is

$$144 \int_{p_1}^{p_2} v\,dp \text{ ft-lb. per lb.}$$

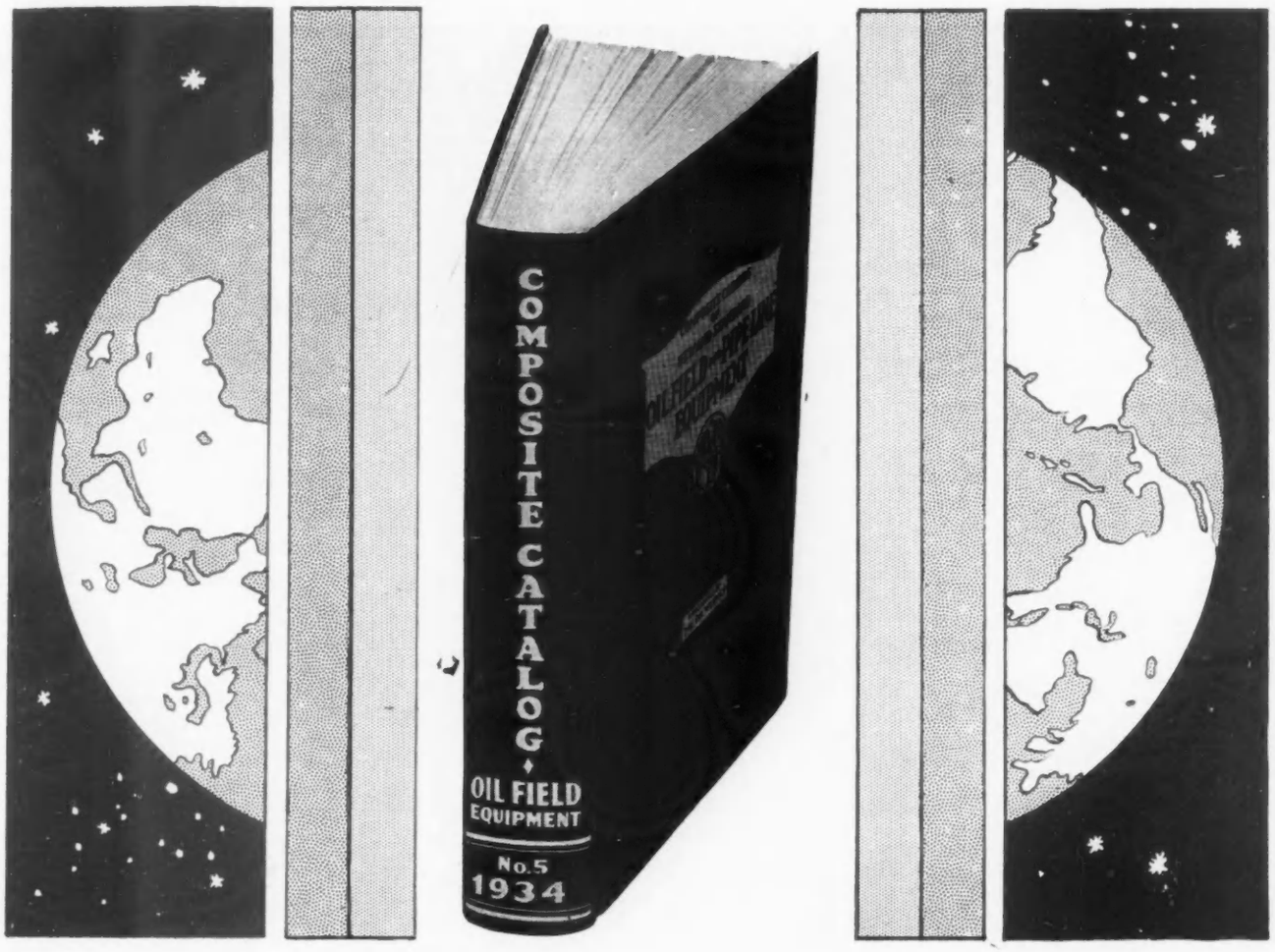
where p_1 and p_2 are the stated pressure limits in pounds per square inch absolute.

Simple graphical integration therefore gives Figure 3, or the more convenient nomographic form Figure 4, where is plotted the energy in foot-pounds per pound of reservoir crude between a given initial and any final pressure.

Experimental Pressure-Depth Curves

With a view to checking the calculated general equation of flow and of evaluating the unknown quantities therein

[2]D. T. Jones: **Proc.** World Petr. Congress, (1934)1, 467.
[3]Lindsly: **Oil & Gas Jnl.** (Jan. 1, 1933).
[4]Reference of footnote 3.
[5]Comins: **Proc.** World Petr. Congress' (1934) 1, 458.
[6]Reference of footnote 5.
[7]Pym: **Proc.** World Petr. Congress (1934) 1, 452.
[8]Reference of footnote 1.
[9]Reference of footnote 7.



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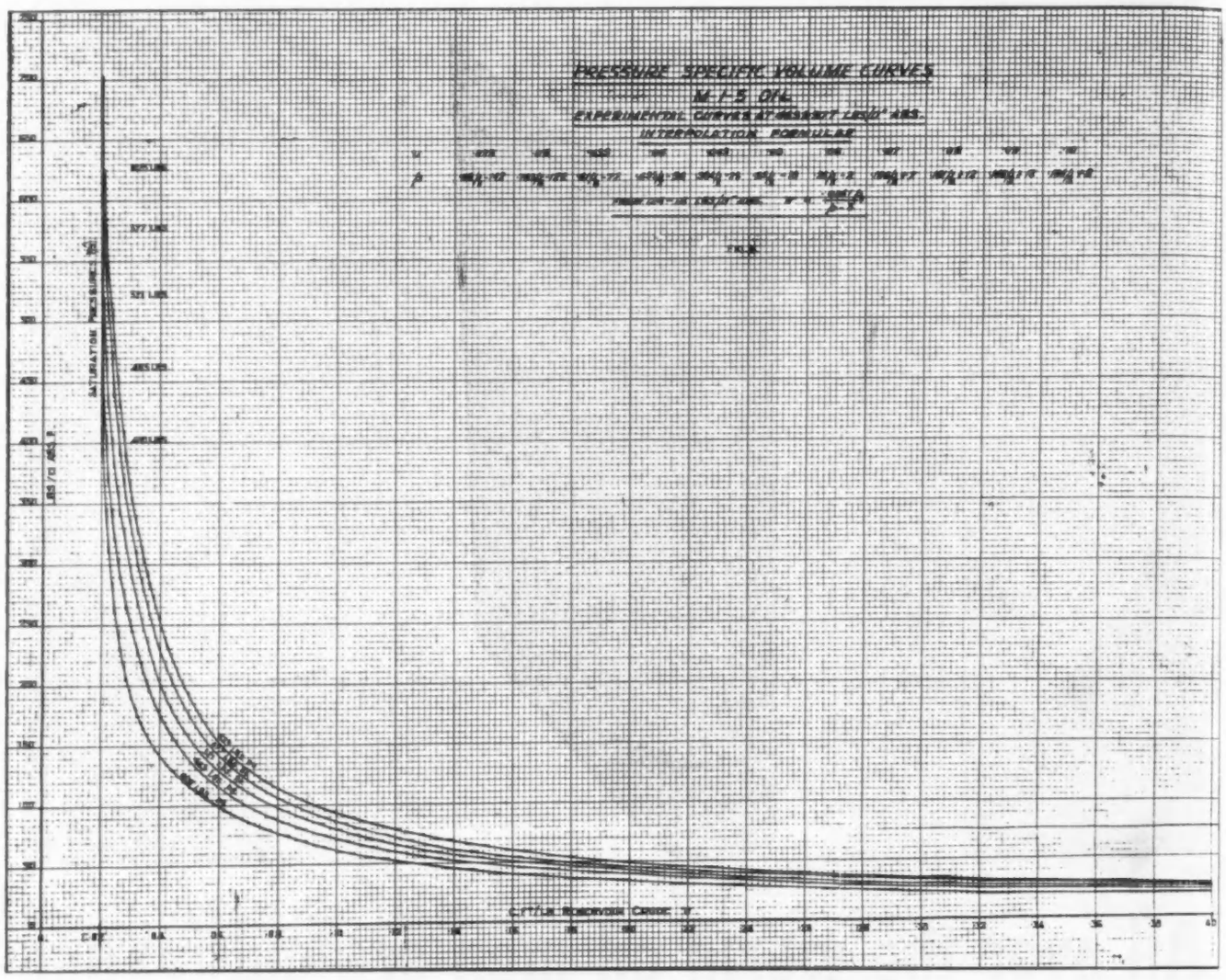

Figure 2—Pressure-specific volume curves, Masjid-i-Sulaiman oil

a number of experiments were carried out on a particular well using various rates of flow and flow-string sizes. The experiments consisted in measuring the pressure at various depths in the flowing well and the experimental points are plotted in Figure 5 for the more important tests, the essential details of which are given in Table 1.

Table 1.—Details of Tests Plotted in Figure 5

Curve Number in Fig. 5	Flow String Inches	PRODUCTION RATE Gal per Day	PRODUCTION RATE Bbl. per Day	Velocity of Gas-free Oil, ft. per sec.	Flow-Head Pressure lb. per sq. in. abs.	Actual Gas-Oil Ratio at Flow Head	Mean Velocity at Flow Head ft. per sec.
I	10	42,000	1,200	0.16	61	5 : 1	0.96
II	10	106,000	3,030	0.39	74	4 : 1	1.9
III	10	554,000	15,800	2.12	91	2.5 : 1	7.4
IV	6½	28,000	800	0.26	72	4 : 1	1.4
V[a]	6½	210,000	6,000	1.99	18-24	25 : 1	52.0
VI[a]	6½	370,000	10,600	3.5	19-22	22 : 1	80.0
VII	6½	520,000	14,850	4.94	82	3 : 1	20.0
VIII	4	11,800	314	0.27	76-77	4 : 1	1.4
IX	4	42,000	1,200	0.99	89.5	2.5 : 1	3.5
X	4	315,000	9,000	7.8	21	8 : 1	74.0

[a]—Flowing through bottom-hole bean.

The general equation of flow given above was then used with suitable values of the constants to calculate the full lines drawn over the plotted points in the figure. As is normally expected, it was found that at high rates of flow, friction was the major cause of loss of energy, and at low rates slippage was the major cause; but it was also found that the two were never simultaneously of appreciable magnitude and at intermediate rates of flow all such energy losses became negligible. Under these conditions the last three terms of the general equation of flow can be equated to zero and we obtain simply

$$144 \int \underline{v}\,dp = \int \underline{dx}$$

or, in other words, the curves of Figure 3 are actual pressure-depth curves. This is demonstrated by curves III and IX of Figure 5 in which the full line is transferred direct from Figure 3 and shows excellent agreement with the two sets of experimental results. At lower rates of flow it is necessary to consider only the effect of slippage in reducing the efficiency of flow.

Slippage

The energy loss known as slippage is due to the tendency of gas to rise in the well faster than the oil. Its calculation is somewhat complicated and considerations of space forbid its being reproduced here. The formula derived in a previous paper is

$$144\,\underline{v}\,dp = \underline{dx} + \frac{144\left(\underline{v} - \frac{1}{\rho}\right)}{\underline{v}\,\frac{\underline{w}}{\underline{Ab}} + 1}\,\underline{dp}$$

the important feature of which is the velocity of slip $\underline{b}$. Ac-

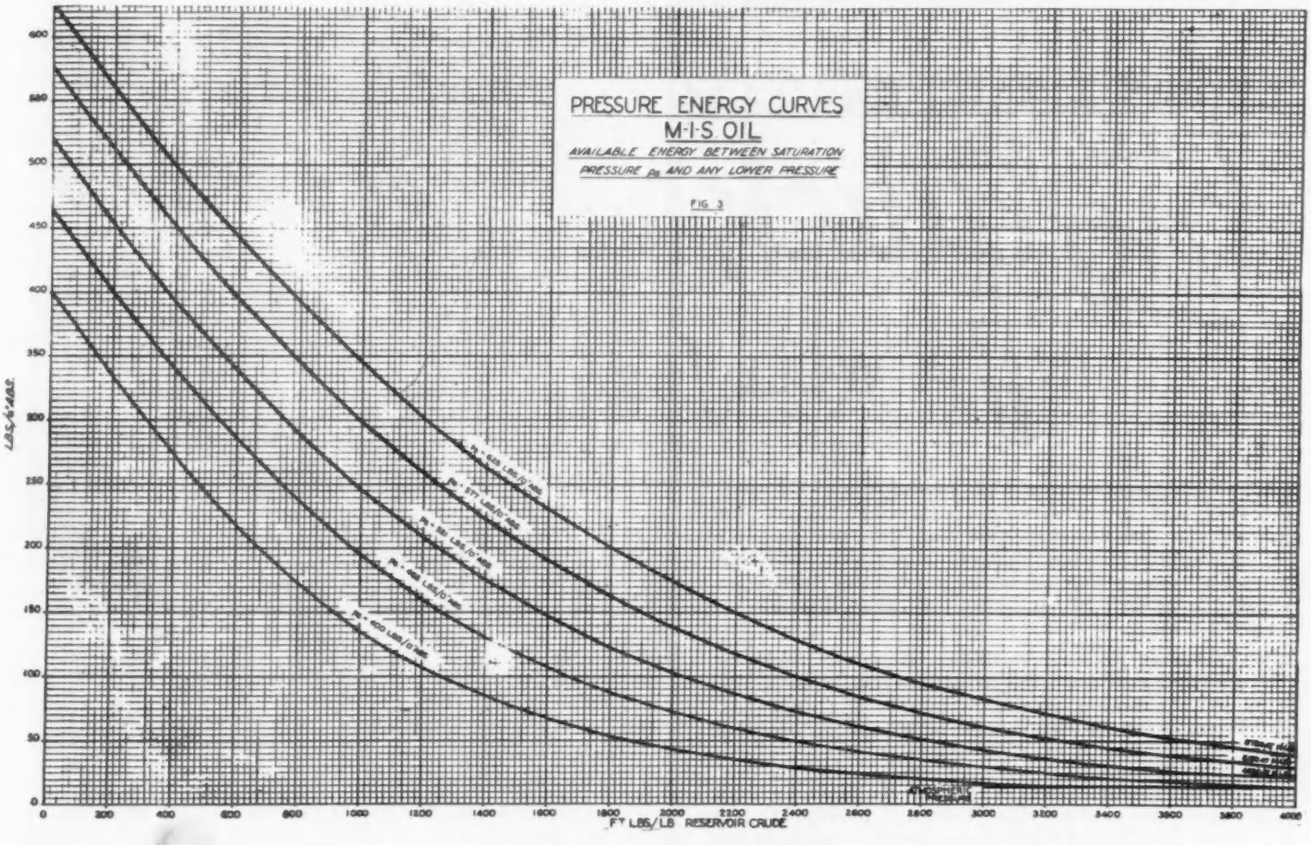

Figure 3—Pressure-energy curves, Masjid-i-Sulaiman Oil. Available energy between saturation pressure p_s and any lower pressure

cording to Versluys,[10] there are two fundamentally different types of flow. In the first there is relatively more oil present than gas and individual gas bubbles rise through a continuous oil phase ($\underline{b}$ = 0.6 — 1 ft. per sec.) As the ratio of gas to oil actually present at the pressure obtaining in the well approaches 1 : 1 slippage decreases to a negligible quantity and then increases again as gas becomes the continuous phase and oil droplets fall through it ($\underline{b}$ = 30 ft. per sec.). These he defines as the foam and the mist conditions. Our results are in general agreement with this conception so far as the so-called foam condition is concerned. Putting $\underline{b}$ = approx. 0.5 in the above formula, the agreement shown in curves I, II, IV and VIII is obtained. The mist condition does not, however, follow immediately the 1 : 1 gas-oil ratio is reached. On the contrary, a stable foam appears to be formed (as shown by the sharp break in each of these curves) in which the slippage loss is negligible and which persists up to gas-oil ratios of at least 5:1 and probably 10:1. At still higher expansion ratios surging sets in, due to the movement of alternate plugs of gas and foam up the casing (curves V and VI) but we have not succeeded under the conditions obtaining in Persia in determining the point at which true mist flow commences. The oil films in the stable foam are obviously approximately flat and not spherical, as is assumed as the basis of Versluys' argument.

Even in fields in which mist flow is important, our method of correcting for the energy loss due to slippage in the lower part of the well should still prove of value. From the above formula it is evident that the slippage is completely determined by the $\underline{p}$-$\underline{v}$ curve and the quantity $\underline{w}/\underline{Ab}$; i.e.:

$$\frac{\text{weight of reservoir crude in lb. per sec.}}{\text{area of casing in sq. ft.} \times \text{velocity of slip in ft. per sec.}}$$

It appears that if $\underline{w}/\underline{Ab}$ is greater than 100, the total energy loss due to slippage in the foam condition amounts to not more than a few foot-pounds per pound of oil, and this, therefore, provides a convenient limit in the design of suitable flow strings. Thus, for example, a 4-in. string has a cross-sectional area of 0.087 sq. ft.; taking $\underline{b}$ = 0.5 for M.i.S. oil, we have for the limiting case $\dfrac{w}{0.087 \times 0.5} = 100$ or $\underline{w}$

= 4.35 lb. per sec.
= approx. 1250 bbl. per day.

At any rate greater than 1250 barrels per day through a four-inch flow string, therefore, slippage can be entirely neglected, with our particular oil. A further simplification arises from the fact that foam slippage ceases abruptly at a point in the well that usually is some distance from the surface. In order to calculate the pressure drop over the whole well therefore we only require to know the *total* slippage loss, which is a function only of the saturation pressure and $\underline{w}/\underline{A}$ ($\underline{b}$ being assumed constant). A nomogram (Figure 6) shows this relationship; the slippage correction read from the diagram is simply added to the depth of the well and Figure 4 is then used to calculate the pressure drop. (See example 2.) It should again be mentioned that we have no information whatever on the subject of mist slippage, which so far has not entered into any of our practical calculations; and some doubt may also be expressed as to the validity of extrapolating our results to cover very small flow strings.

Friction

According to the ordinary theory of fluid flow the energy loss due to friction is proportional to the velocity and to the viscosity of the fluid at low values of the

[10]Versluys: Trans. A.I.M.E. (1930) **86**, 192; ibid. (1931) **92**, 279; Jnl. Inst. Petr. Tech. (1933) **19**, 694.

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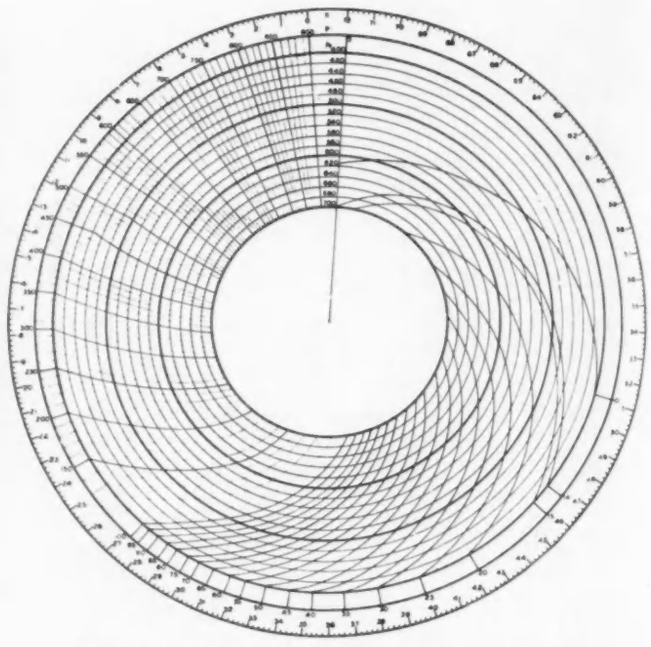


Figure 4—Pressure-available energy monogram.

Reynold's criterion $\frac{uD\rho}{\eta}$ and to the square of the velocity and independent of the viscosity at high values. It is by no means easy to ascribe a rational value to the viscosity of a heterogeneous mixture of gas and oil, and in the only detailed experimental work previously published on the subject a purely empirical eq.[n] is used for the calculation of friction loss [11], [12].

$$\Delta p_{fr} = 0.00125 \frac{u \rho Z^{0.18}}{d}$$

where ΔP_{fr} is the friction loss, u the velocity, ρ the density and Z the viscosity of the oil phase. There seems to be no theoretical justification for such a formula and we in fact find that at high rates of flow the ordinary formula holds:

$$d w_4 \frac{4 k v^2 w^2}{g D A^2} d x$$

where k is a constant independent of the velocity. (It should be observed that the value of k depends upon the relative roughness of the pipe and is slightly different for different diameters).

If the two formulas given above are compared they will be found to give approximately the same numerical result at a velocity of one foot per second. It is necessary to go to a velocity of some four feet per second before the friction loss on our formula amounts to as much as one percent of the total energy; therefore we feel that, although derived from experiments at high velocities, the formula can be used for all practical purposes over the whole range. Curves VII and X, Figure 5, were calculated on this basis with added correction for velocity head; in curves V and VI the apparent spread is due to surging.

For the purposes of calculation, it will be evident that

[11] Moore and Schilthuis: **Trans. A.I.M.E.** (1933) **103**, 170.
[12] Reistle and Hayes: U. S. Mines **Rept. of Investigations** 3211 (1933).

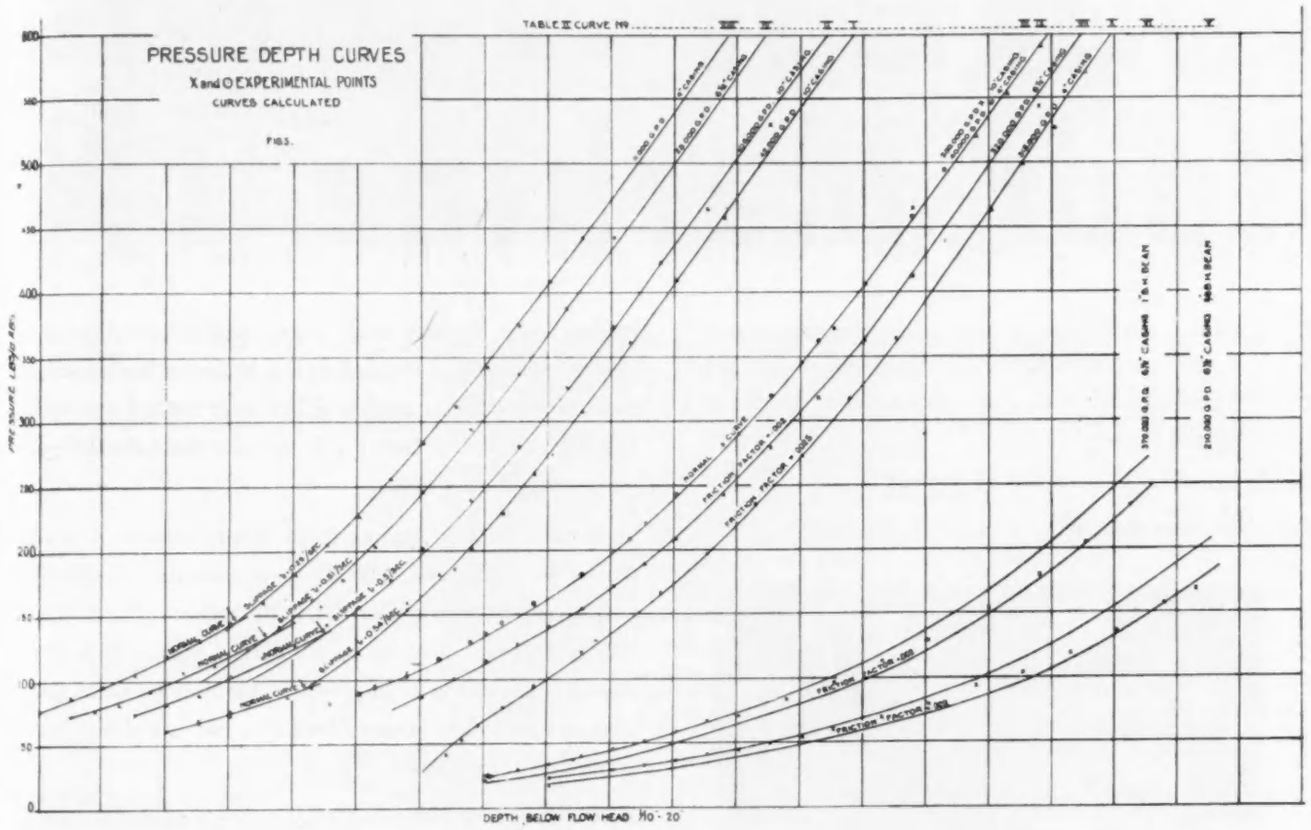


Figure 5—Pressure-depth curves. X and Θ experimental points calculated

the calculated flowing pressure of a well will be greater if we neglect friction than if friction is included. It would be possible to plot the difference between these two pressures for various conditions of flow in the form of a nomogram. This would however be somewhat complicated and a simpler form is shown on Figure 7. Advantage is taken of the fact that below about 120 pounds per square inch the p-v curves are very nearly true hyperbolas and are represented by the formula $v = \frac{0.0141\,p_s}{p-5}$ for M. i. S. oil.

Over this range it is therefore possible to integrate the general eqn of flow to give

$$X = 72 \times 0.0141\,\frac{p}{s} \times 2.3 \left[\log_{10} \left\{ (p-5)^2 + \frac{0.0141^2\,p^2\,4\,k w^2}{s\,g\,D\,A^2} \right\} \right]_{p_2}^{p_1}$$

$$-\frac{2.3\,D}{8\,k} \left[\log_{10} \left(v^2 + \frac{g\,D\,A^2}{4\,k w^2} \right) \right]_{v_1}^{v_2}$$

where x is the depth of the well and the last term is the velocity head correction discussed below.

A nomogram is therefore constructed to cover the friction correction at high pressures and the formula is used at low pressures. An example of the method of calculation is given below (Example II).

Velocity Head

At very high rates of flow it is necessary to apply a correction for velocity head which follows normal theory. We have

$$\int d\,w_2 = \frac{u^2}{2g} = \frac{v^2 w^2}{2\,g\,A^2}$$

$$\text{whence } d\,w_2 = \frac{v\,w^2}{g\,A^2}\,dv$$

(The application to the calculation of the maximum throughput of a bean on the lines of the ordinary steam-jet theory has been discussed in a previous paper but is too long to be included here.)

It is only rarely necessary to apply this correction, since it is barely measureable even with a velocity at the flow head of 20 feet per second. At such rates slippage is absolutely negligible and the eqn of flow becomes.

$$dE = 144\,v dp = dx + \frac{v\,w^2\,dv}{g\,A^2} + \frac{4\,k\,v^2\,w^2\,dx}{g\,D\,A^2}$$

$$\text{or } \int dx = \int \frac{144\,v dp}{1 + \frac{4\,k\,v^2\,w^2}{g\,D\,A^2}} - \int \frac{v\,w^2\,dv}{g\,A^2 \left(1 + \frac{4\,k\,v^2\,w^2}{g\,D\,A^2} \right)}$$

The last term on the right-hand side is the velocity-head correction and on integration yields:

NOW . . . Belts Your Machine IN

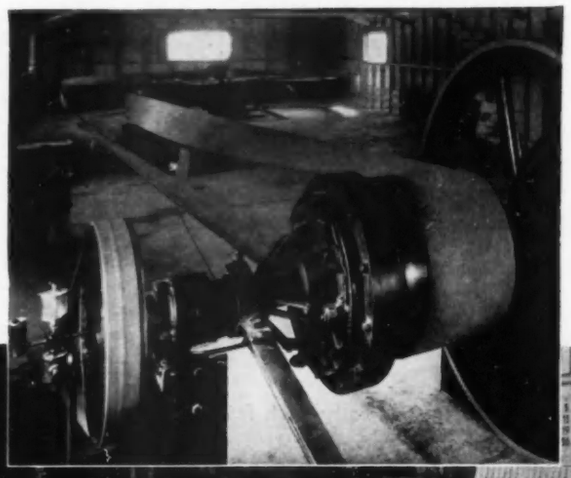
EVERY plant engineer recognizes the superiority of endless belts. But they have required dismantling of the drive, or have taken 2 to 3 weeks to get from the factory.

No longer.

Goodrich announces the Plylock Splice* for Highflex rubber belts, for use with a new portable vulcanizer in your plant. This Plylock Splice makes a better joint than any leather or rubber splice ever before made in the field or in the factory. It will increase the life of most belts 2 to 3 times.

Most belt trouble comes from the fasteners. At one stroke you can cut out all such trouble, simply by employing this new Goodrich Plylock method. You reduce danger of injury to your men, you reduce idle machine time, you reduce belt maintenance time and cost . . . and you increase belt life, belt service, plant production, net profit.

Belt ends can be prepared in advance, and the Plylock Splice can then be vulcanized by any mechanic, on your



TOP LEFT

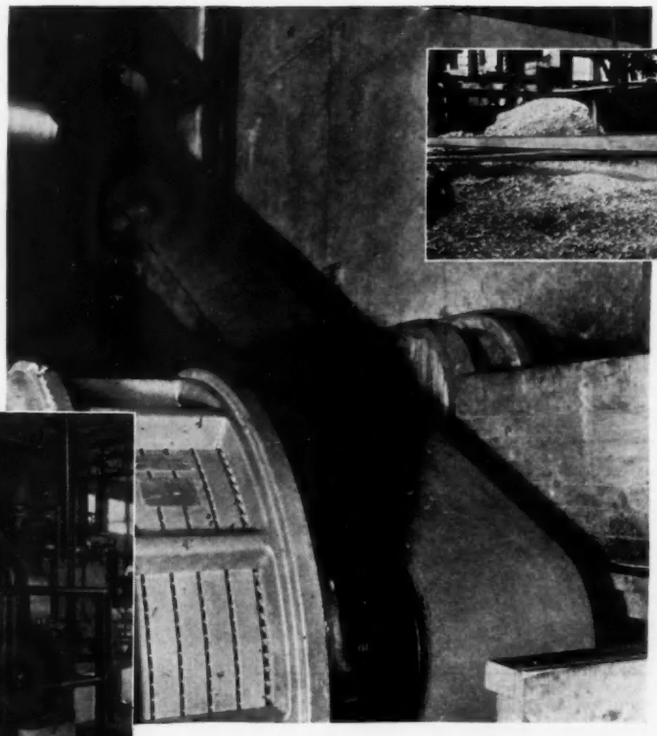
An endless Highflex Belt in the oil fields, driving a band-wheel power.

Cutting the Plylock Splice, preparatory to making a Highflex Belt endless on the machine. Any good mechanic can learn the complete operation in a few hours.

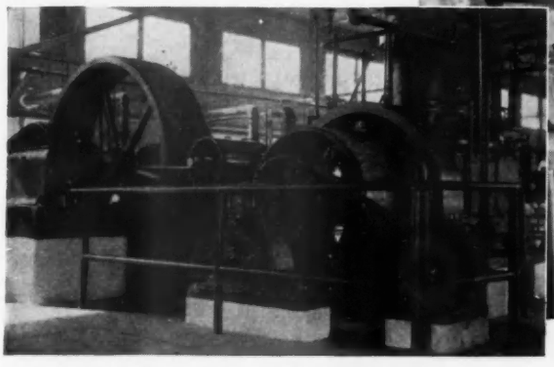
Goodrich

Made Endless on A FEW HOURS

On paper mill drives, Highflex again demonstrates its value as a money-saver. Here is the belt which does not cause costly shutdowns. Can be made endless on the machine, and costs less every time.



Gas compressor in California, driven by endless Highflex.



This endless Highflex belt, operating a shaper in a western lumber company, has already outlasted every other type of belt ever before used on this drive.

machine in a few hours—and then used immediately. Small belts, 3 or 4 inches wide, need less time, frequently less than an hour.

Vulcanizers for this Plylock method cost from $45, depending on the size of belt you use, and in most plants pay for themselves in a few months. Or, most Goodrich Distributors are equipped to do the work for you, in their shop or on your machine.

ALL *products*™ *problems* IN RUBBER

Test cases of Plylock endless belts have been running for two years, on all types of drive. They prove conclusively that this revolutionary method doubles the life of many belts and invariably cuts belt cost drastically. Let your Goodrich Distributor show you what it can do in your plant. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

* Patent applied for

Highflex Belting

We're so proud of Highflex that we give it a permanent brand—the *red edge*—the mark of the belt with the 14 new improvements.

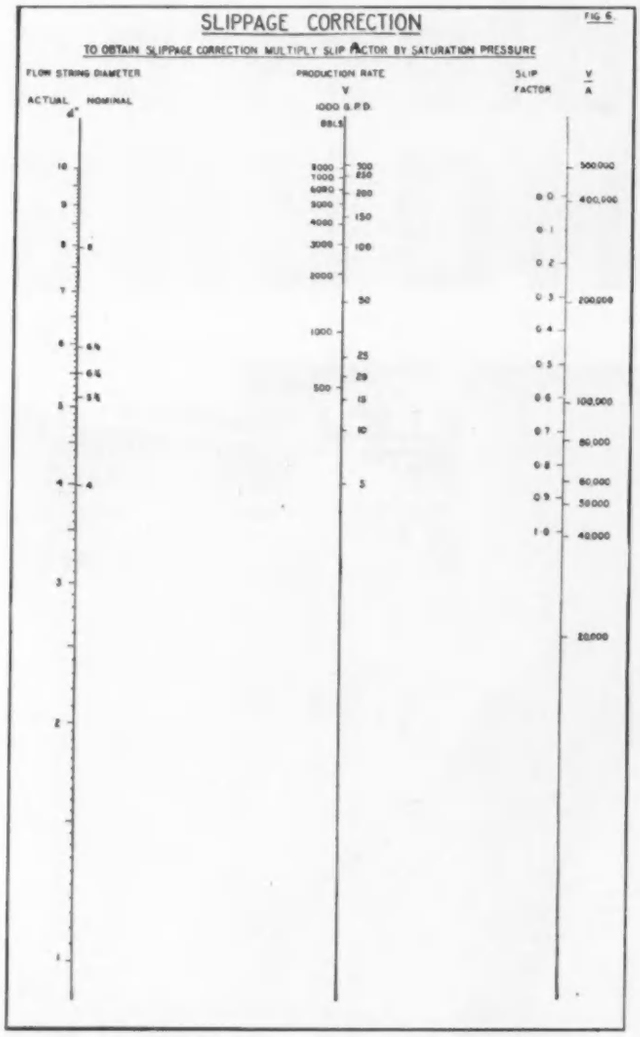


Figure 6—Slippage correction. Multiply slip factor by saturation pressure.

$$-\frac{2.3\,\underline{D}}{8\,\underline{k}}\left[\log_{10}\left(\underline{v}^2+\frac{\underline{g}\,\underline{D}\,\underline{A}^2}{4\,\underline{k}\,\underline{w}^2}\right)\right]_{\underline{v}_1}^{\underline{v}_2}$$

See example 2.

Practical Applications

A few examples illustrating the use of the methods and nomograms described are appended. They represent actual experimental data obtained on the field.

Example 1.—Well A. Depth, 3088 feet; casing, 10-inch; production rate, 2380 barrels per day; flowing pressure, 49.5 pounds per square inch absolute; sat.ⁿ pressure, 524 pounds per square inch absolute. To calculate the bottom-hole pressure.

The production rate is so low that there is no appreciable friction. On the slippage-correction nomogram (Figure 6) take a line through 10-inch on the left-hand scale and 2380 barrels per day on the middle scale. On the right-hand scale read a slip factor of 0.42. Multiply by the saturation pressure to give the slippage correction $0.42 \times 524 = 220$. Total energy required in well is therefore $3088 + 220 = 3308$ foot-pounds per pound. Turn to the nomogram, Figure 4. Take the point where the curve $\underline{p} = 49.5$ cuts the circle $\underline{p_s} = 524$ and join to the center; extend the line and read 3950 on the outer circle. This corresponds with the flow head; ∴ join the center to the point $3950 - 3308 = 642$. On the circle $\underline{p_s} = 524$ read the pressure $\underline{p} = 680$ lbs. per sq. in. abs. (Actually measured pressure = 684 lbs.)

Example 2.—Well B. Depth, 2100 feet; casing, four-inch; production rate, 9000 barrels per day; flowing pressure, 41.5 pounds per square inch absolute; sat.ⁿ pressure, 465 pounds per square inch absolute. To calculate the bottom-hole pressure.

This example is rather more complicated. There is no slippage but considerable friction and velocity head (it represents in fact curve X, Figure 5). To begin with the nomogram, Figure 7 gives the friction correction down to a pressure of $0.161\,\underline{p_s} + 12$; in this case $0.161 \times 465 + 12 = 87$ pounds per square inch absolute. Between this pressure and the flowing pressure of 41.5 pounds we use the formula:

$$\underline{X} = 72 \times 0.141\,\underline{p_s} \times 2.3\left[\log_{10}\left\{(\underline{p}-5)^2+\frac{0.0141^2\,\underline{p_s}^2\,4\,\underline{k}\underline{w}^2}{\underline{g}\,\underline{D}\,\underline{A}^2}\right\}\right]_{\underline{p}_2}^{\underline{p}_1}$$

$$-\frac{2.3\,\underline{D}}{8\,\underline{k}}\left[\log_{10}\left(\underline{v}^2+\frac{\underline{g}\,\underline{D}\,\underline{A}^2}{4\,\underline{k}\,\underline{w}^2}\right)\right]_{\underline{v}_1}^{\underline{v}_2}$$

The value of $\dfrac{4\,k\,w^2}{g\,D\,A^2}$ read from the nomogram is 132 and $\underline{k}$ for four-inch pipe is 0.0025. The formula therefore reduces to:

$$\underline{X} = 72 \times 0.0141 \times 465 \times 2.3\,\log_{10}\left\{\frac{(87-5)^2+0.0141^2\times 465^2\times 132}{(41.5-5)^2+0.0141^2\times 465^2\times 132}\right\}$$

$$-\frac{2.3\times 0.33}{8\times 0.0025}\log_{10}\left\{\frac{0.186^2+\frac{1}{132}}{0.08^2+\frac{1}{132}}\right\}$$

The value of $\underline{v}$ corresponding to the flowing pressure ($\underline{v} = 0.186$) is read from Figure 2.

The arithmetical solution of this equation is $\underline{x} = 250$; i. e., the pressure is 87 pounds, 250 feet below the 41.5-pound pressure point (this can be checked on the curve $\underline{x}$, Figure 5). Between this pressure and saturation pressure, if there were no friction, the corresponding depth in the well would be 1800 feet from the curve of Figure 3.

From Figure 7 the friction correction is 0.68 (scale reading corresponding to $\dfrac{4\,k\,w}{A^2\,g\,D} = 132$) 0.68×465 (saturation pressure) = 316 feet. Between 87 pounds and 465 pounds per square inch absolute, the corresponding depth in the well is, therefore, $1800 - 316 = 1484$ feet.

Above saturation pressure there remains therefore $2100 - 1484 - 250 = 366$ feet.

Again, from the last column of Figure 7, the lift per pound pressure drop at this particular rate of flow is 2.79 feet per pound. Therefore 366 feet corresponds to 131 pounds per square inch and the bottom-hole pressure is $465 + 131 = 596$ pounds per square inch absolute (actual observed pressure, 600 pounds per square inch).

Example 3.—Well C. Depth, 2118 feet; casing, 10-inch; production rate, 12,000 barrels per day; flowing pressure, 90 pounds per square inch; bottom-hole pressure, 546 pounds per square inch. To calculate the saturation pressure.

The nomograms, Figures 6 and 7, show that both fric-

tion and slippage are negligible. On Figure 4 take a vertical line passing through $\underline{p} = 546$ (the variation with saturation pressure in this region is small). Read off 1020 feet in the outer circle. Add the depth of the well and obtain 3138. Take a line from the center to 3138 and where it cuts the $\underline{p} = 90$ pounds line read off the saturation pressure 495 pounds per square inch absolute.

Many variations of these methods are possible and suggest themselves in the course of ordinary field work. They have been applied in Masjid-i-Sulaiman to the calculation of pressure drops over a very wide range of conditions, and, provided that flow is steady, the maximum divergence from the experimental figure has been equivalent to about 2.5 percent of the total energy used in the well; in the great majority of cases the error is less than 1 percent.

Considerations of space have made it impossible to do more than give a very brief outline of the subject in the present paper, but it is hoped that it will serve the purpose of stimulating discussion on an extremely important topic.

Acknowledgment

The author's thanks are due to the chairman and directors of the Anglo-Persian Oil Company for permission to publish the results of this investigation.

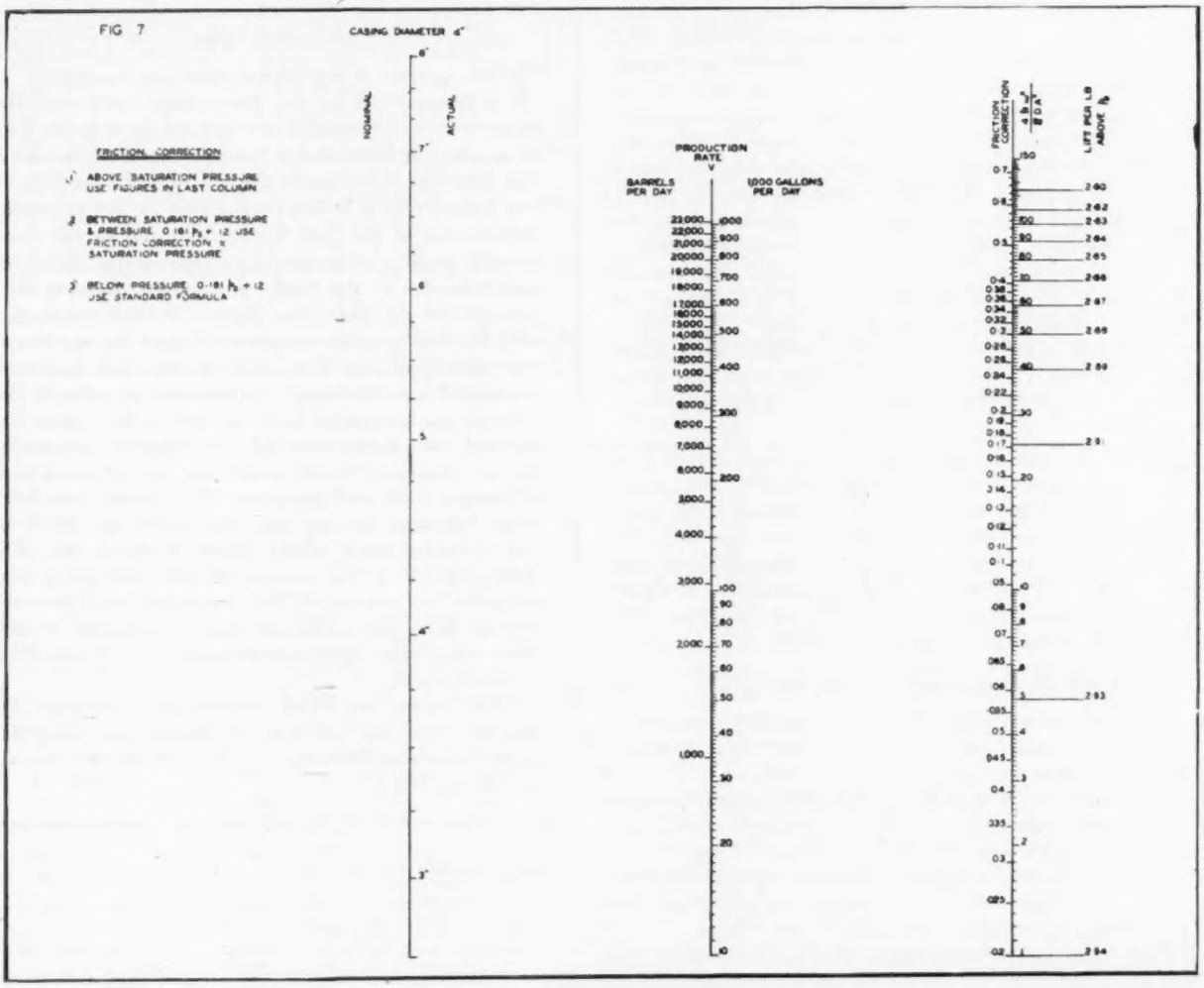


FIG 7
CASING DIAMETER d"
NOMINAL
ACTUAL
FRICTION CORRECTION
1 ABOVE SATURATION PRESSURE USE FIGURES IN LAST COLUMN
2 BETWEEN SATURATION PRESSURE & PRESSURE 0·161 p_s + 12 USE FRICTION CORRECTION X SATURATION PRESSURE
3 BELOW PRESSURE 0·161 p_s + 12 USE STANDARD FORMULA
PRODUCTION RATE V
BARRELS PER DAY
1000 GALLONS PER DAY
FRICTION CORRECTION
LIFT PER LB ABOVE p_b

Figure 7—Friction correction. 1—Above saturation pressure, use figures in last column. 2—Between saturation pressure and pressure 0.161 p_s + 12 use friction correction X saturation pressure. 3—Below pressure 0.161 p_s + 12 use standard formula.

Variations *in Reservoir Pressure In the* East Texas Field

RALPH J. SCHILTHUIS and WILLIAM HURST
Research Engineers, Humble Oil & Refining Company, Houston, Texas

Reservoir Pressure Data

THE reservoir pressure data on the East Texas field have shown conclusively that the pressures are readily affected by changes in the rate at which the field is produced. This can well be seen in Figure 1, where the average reservoir pressures obtained from time to time are plotted with the daily production rates and the cumulative production of the field. It is noted that the average reservoir pressure has declined irregularly, depending upon the rate of production, from the estimated original value of 1625 pounds per square inch to the value of 1228 pounds per square inch observed for August 11, 1934. The decline in pressure has been more rapid at the higher rates of production than at the lower rates. In contrast, the average reservoir pressure has increased, on several occasions, upon reduction of the withdrawal rate from a high value to a lower value.

The reservoir pressure data have also shown that a definite gradient in pressure has existed across the field from west to east since the beginning of production. The pressures are highest on the west boundary of the field, decreasing gradually to the east edge. The magnitude of this pressure gradient is also influenced by the rate of production, the difference in pressure from west to east becoming greater as the production rate is increased.

Physical Properties of Reservoir Oil

Lindsly[1], in his investigations on the physical properties of the reservoir oil in the East Texas field, demonstrated the following facts:

1—The reservoir oil is undersaturated with gas, the saturation pressure being 740 pounds per square inch gage. This pressure, which corresponds to the point where gas first starts to escape solution, is several hundred pounds per square inch less than the lowest average pressure that has ever been observed in the East Texas field.

2—Above the saturation pressure of 740 pounds per square inch, the reservoir oil has a liquid expansibility of 0.098 percent for each reduction of 100 pounds per square inch in the pressure upon the liquid.

3—The reservoir oil, in being produced to the surface, shrinks, or suffers a net loss in volume of about 20 percent. The shrinkage is due mainly to liberation of dissolved gas upon reduction in pressure from the saturation pressure to one atmosphere. A small part of the contraction is accounted for, however, by reduction in temperature from the reservoir temperature of 146°F. to the temperature at the surface.

These physical properties of the East Texas reservoir oil have also been investigated and checked, within reasonable limits, in the laboratories of the Humble Oil & Refining Company.

Interpretation of Data

In the foregoing, the most important information concerning the behavior of the reservoir pressures and the physical properties of the reservoir oil in the East Texas field have been reviewed.

A little reflection on the fact that the reservoir oil is undersaturated will make it evident that the oil body must be acted upon by some extraneous force, which maintains the pressure in excess of the saturation pressure of the oil. If there were no such force, the reservoir pressures would have fallen, rapidly, below 740 pounds per square inch.

Regarding the nature of the extraneous force, it has been suggested[2] that the weight and compressibility of the overlying sediments and rocks supplies the excess pressure. J. O. Lewis[3] has shown that this suggestion is untenable. Both the original and current average reservoir pressures can be explained by water pressure or a water drive acting upon the oil body. The contention that a water drive does act upon the field is compatible with both geological information and the data on reservoir pressures and the physical properties of the reservoir fluids.

Figure 2 is a map of the East Texas area showing the relation between Woodbine formation and the East Texas oil field. The Woodbine formation outcrops in a belt extending northward from McLennan County, Texas, to the Red River valley and then eastward to the Oklahoma-

INTRODUCTION

THE nature of the forces that are important in producing oil in the East Texas field and the manner in which these forces are affected by the rate of production have always been problems of outstanding interest. These questions are of great interest to the industry as a whole on account of the economic importance of the East Texas field and to the engineers in particular on account of the unique character and behavior of the field. Subsurface pressure data throughout the field have been collected systematically so that a quite complete history of the reservoir pressures has been kept as the field has been developed and produced. Subsurface samples of the oil and gas have been taken and these have been examined to obtain data on the physical properties of the reservoir fluids under the actual conditions of temperature and pressure. All of these data have been valuable because they have afforded the basis for a careful study of the means by which the oil is produced. It is the purpose of this discussion first to point out several of the important facts revealed by the data mentioned and then to describe studies that have been made concerning the interpretation of these facts.

This paper was read before the Petroleum Division, American Institute of Mining and Metallurgical Engineers Meeting, at Tulsa, Oklahoma, October 12-13, 1934.

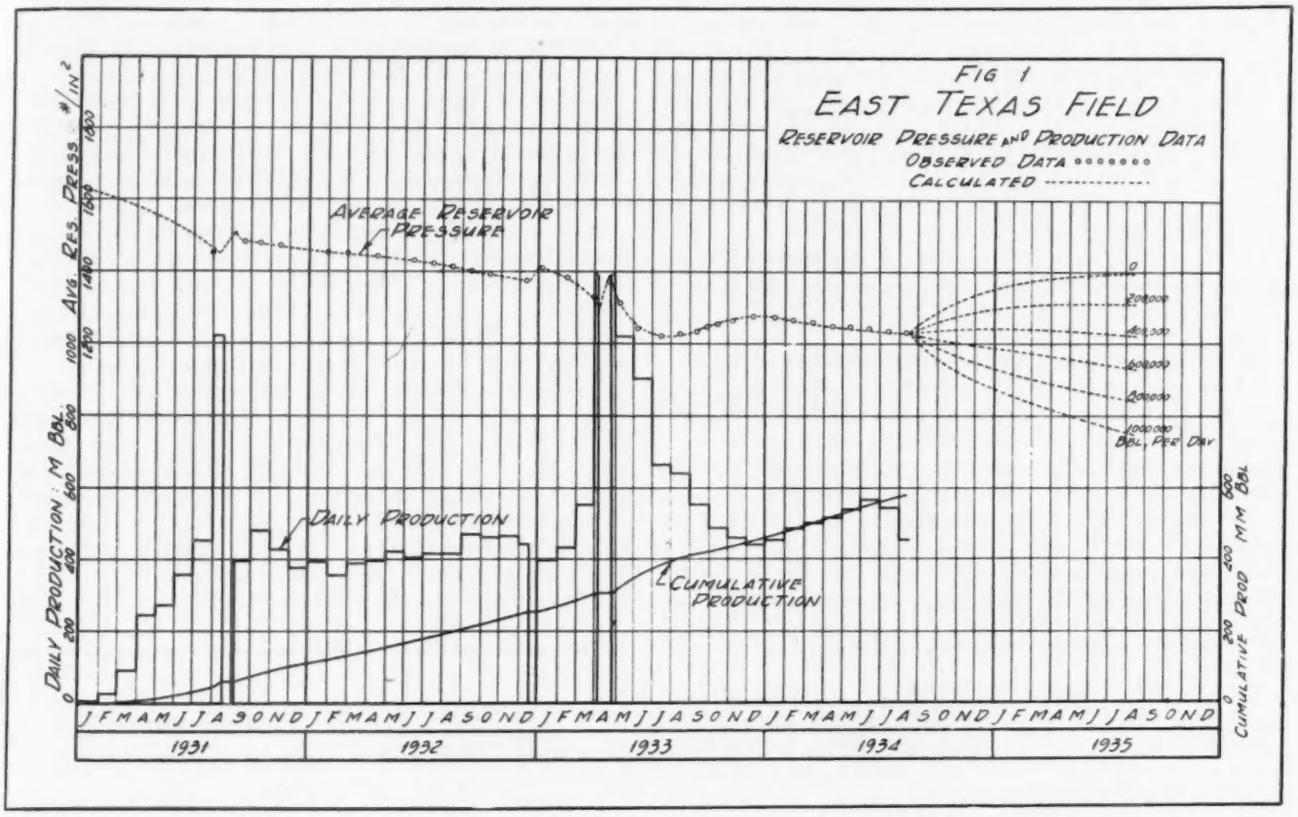


FIG 1
EAST TEXAS FIELD
RESERVOIR PRESSURE AND PRODUCTION DATA
OBSERVED DATA
CALCULATED
AVERAGE RESERVOIR PRESSURE
DAILY PRODUCTION
CUMULATIVE PRODUCTION
DAILY PRODUCTION M BBL
AVG. RES. PRESS. #/IN²
CUMULATIVE PROD M M BBL
BBL. PER DAY
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1931
1932
1933
1934
1935

Arkansas border. The formation dips southeastwardly, pinching out to the south, and finally rises gradually to the east to pinch out against the Sabine uplift and make the reservoir in which water has trapped out to form the East Texas oil field. The field occupies only a small part of the vast Woodbine formation, being located at the approximate center of the Woodbine's eastern boundary. There is sufficient evidence to show that the Woodbine sand is continuous from its outcrop to the East Texas field and is filled with water. The head of water equal in height to the difference between the surface elevation of the Woodbine's outcrop and the sub-sea depth of the oil reservoir would exert a static pressure in close agreement with original reservoir pressure. The fact that since production began a gradient in pressure has existed across the field from west to east further substantiates the contention that the field is under water drive and indicates that the water is tending to push the oil body eastward in the reservoir.

Nature of Water Drive

Having pointed out that the oil in the East Texas field is undoubtedly acted upon by a water drive, it becomes necessary to inquire as to the behavior of the water drive as production goes on.

As soon as production started, the reservoir pressure began to decline below the original value about the wells produced. This lowering of the pressure allowed the oil in the vicinity of the wells to expand and fill the space formerly occupied by the oil removed. As production continued, the lowering of the pressure spread rapidly to the more remote parts of the field on account of the limited expansive power of the remaining undersaturated reservoir oil. It was observed, however, that as more oil was produced the pressures did not decline as rapidly as would be consistent with the expansibility of the remaining undersaturated oil and the quantities of oil removed. This condition indicated that the pressure differential set up between the higher pressure in the water sand to the west and the lowered pressure in the oil reservoir itself had caused water to encroach into the field. Such encroachment of water moved oil ahead of it toward the producing wells, the oil so moved filling the space formerly occupied by oil produced and thus retarding the decline in pressure. There is no doubt that water did encroach into the oil reservoir, for, if the water had not moved in, the expansibility of the undersaturated remaining oil would permit less than 70,000,000 barrels of production before the reservoir pressure would have been reduced to the saturation pressure of the oil; namely, 740 pounds per square inch. The fact that much larger quantities of oil have been produced without causing such a large decline in pressure proves that the water drive is effective. The data indicate that about five percent of the vacated space has been filled by expansion of oil left in the reservoir, while the remaining 95 percent has been filled by intrusion of water. As the oil shrinks by 20 percent upon being produced to the surface, about 1.18 barrels of water move into the field for each barrel of oil measured in the stock tanks.

Originally, the approximate western half of the East Texas field was underlain by water, the water level being at 3320 feet subsea. It is calculated that to make it possible for the water to have encroached to occupy its share of the space left vacant by the total oil produced up to August 1, 1934, the water level would necessarily have had to rise 10.0 feet, assuming that the sand flooded with water still retains 25 percent of its original store of oil and that the water rose absolutely uniformly. There are data to indicate that the water level has not risen to this extent on the western or water edge of the field. It should be pointed out, however, that these data are undoubtedly misleading. As water underlies the western half of the field and as the greater portion of the total oil produced has been taken from the central portion of the field, the water has, in all probability, risen much higher toward the middle of the field than on the western edge. This uneven rise of the

water level could easily have occurred without being detected on account of the fact that the oil section becomes thicker toward the longitudinal center of the field and that nearly all wells penetrate only two thirds of the distance between the top of the sand and the water level. As evidence to support this reasoning, it is called to mind that there are a number of normal depth wells, slightly to the east of the field's longitudinal center, making water. The bottoms of these wells are as much as 10 to 70 feet above the original water table, indicating that the water level certainly could have risen enough, in an uneven manner, to agree with the total water encroachment required to fill all the space formerly occupied by the oil that has been produced.

Mechanism of Water Drive by Expansibility of Water

There are but two methods by which water may move into the East Texas reservoir as oil is produced. The first possibility is that water enters the Woodbine formation at its outcrop and flows through the entire sand body to the oil field. The second possibility is that the flow of water is supplied by virtue of the expansive power of the water contained in the Woodbine sand. Consideration of the first mentioned method has shown that the flow of water through the sand, over the great distance between the outcrop and the oil reservoir, would entail such great friction loss and hence such large pressure drops that the water could not be supplied at the required rate under the existing pressure in the East Texas field. Concerning the second possible method, it would probably be concluded at first thought that the effect of the slight expansibility of water would be negligible. However, when the expansion of the tremendous quantities of water contained in the vast expanse of Woodbine sand is considered, relative to the quantities of water moving into the East Texas field, it is realized that the effect is important and must certainly be taken into account. The Woodbine sand is estimated to contain roughly four trillion barrels of water. It is estimated that, if the pressure on such an enormous quantity of water were lowered by only 50 pounds per square inch, it would expand and supply enough excess water to fill the space vacated by all of the oil produced from the East Texas field to date. This example is given only to illustrate the magnitude of the amount of excess water which can be supplied by expansion of so large a body of water as is contained in the Woodbine sand. It is not at all meant to imply that the pressure is actually lowered over the entire body of water by a constant amount.

The mechanism by which water flows into the East Texas

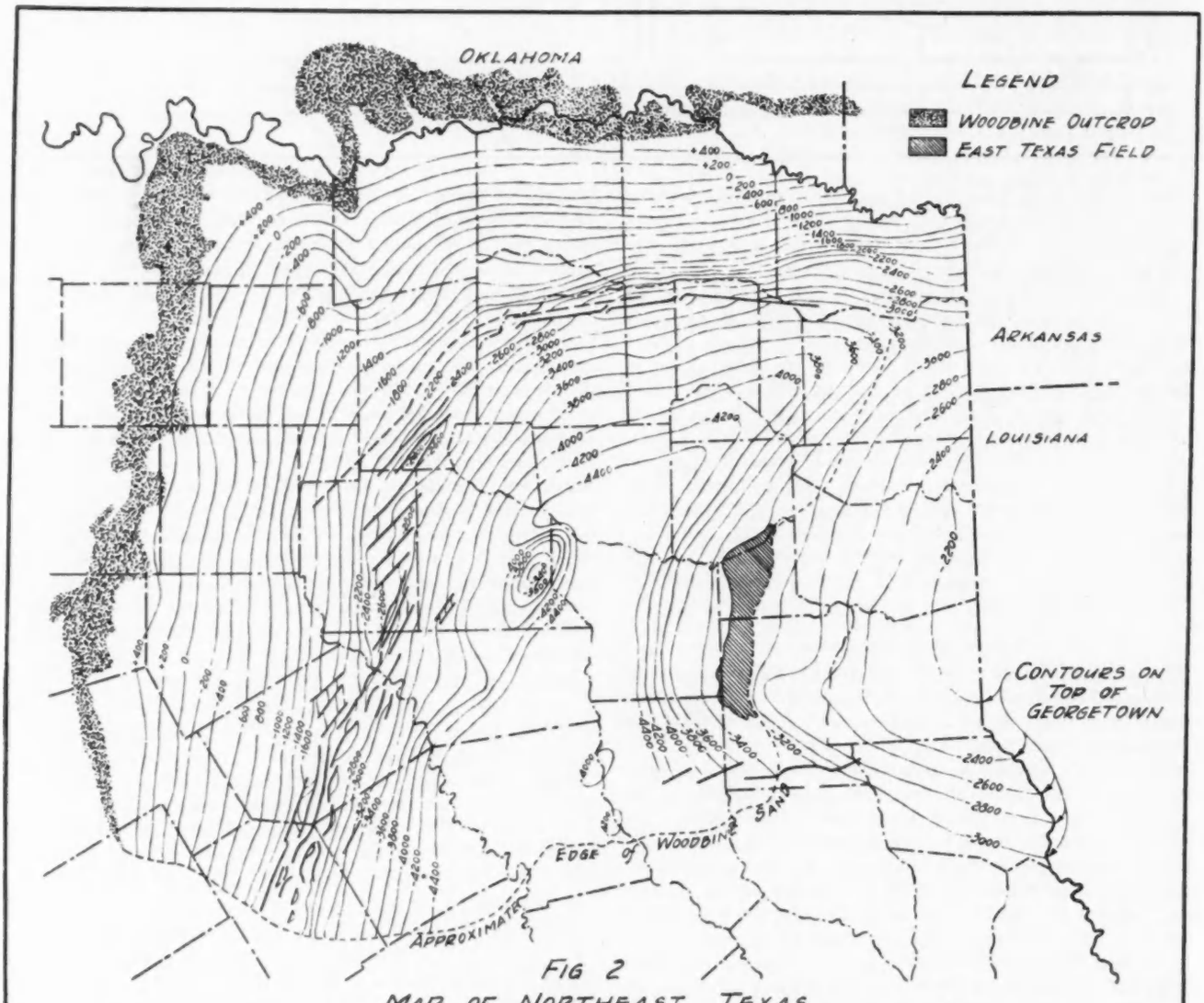
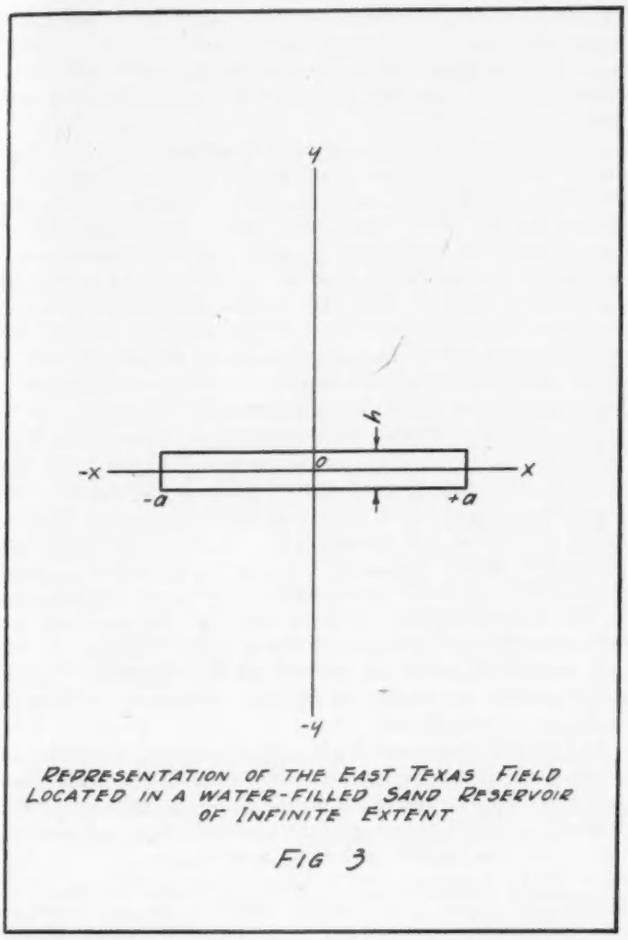


FIG 2
MAP OF NORTHEAST TEXAS
SHOWING
STRUCTURE CONTOURS ON TOP OF THE WOODBINE SAND



REPRESENTATION OF THE EAST TEXAS FIELD LOCATED IN A WATER-FILLED SAND RESERVOIR OF INFINITE EXTENT

FIG 3

field, on account of its expansibility, is as follows: When production first started, the pressure in the reservoir and on the water adjacent to the oil body on the west was lowered. This allowed the water to expand and drive oil eastward to fill space vacated by oil produced. As production has continued, the pressures have been progressively lowered and the water has been caused to flow toward the field from greater and greater distances out in the Woodbine sand. This type of flow is essentially the same as that by which oil and gas flow to a well bore[4,5] from the surrounding formation when the pressure at the well is lowered.

Mathematical Analysis of East Texas Water Drive

In order to quantitatively evaluate the importance of the water drive on the East Texas field, a mathematical analysis of the described mechanism or type of flow by which water moves into the reservoir has been made. This analysis has been submitted for publication by William Hurst. To develop the analysis, it was necessary to make certain assumptions, as follows:

1. The permeability, porosity, and thickness of the Woodbine sand are uniform and the formation is horizontal throughout that portion of the sand influenced by production from the field.

2. The velocity of fluid flow at any point is directly proportional to the pressure drop per unit length along the path of flow.

3. The fluids expand as pressure is lowered, the volume of the fluids increasing a certain definite percentage for each pound per square inch decrease in pressure.

*For definition of symbols, see table of nomenclature at end of paper.

With the foregoing assumptions, the analysis was based upon a material balance of the fluids flowing through a very small element of the sand formation toward the East Texas field, which is represented in Figure 3 as the rectangle of length **2a** and width **h** located at the origin of rectangular coordinates in an infinitely large water filled sand reservoir. The material balance is expressed by the differential equation*,

$$\left[\frac{\partial^2 \rho}{\partial x^2} + \frac{\partial^2 \rho}{\partial y^2} \right] \frac{K}{\Phi c} = \frac{\partial \rho}{\partial \Theta}$$

The general solution of this equation for the East Texas water drive problem is[6],

$$\rho = \frac{1}{4\pi oc^2\Theta} \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} f(x,^1 y^1)\ e - \frac{(x - x^1)^2 + (y - y^1)^2}{4\, oc^2\Theta}\, dx^1\, dy^1$$

The particular solution, for the East Texas problem, is,

$$0.422 \frac{HK}{c} \left[1 - e - 144\ c\ (P_R - P_F) \right] =$$

$$\int_{G1}^{o} q_F\ (\Theta^1)\ d \left\{ \log_{10} \left[\frac{oc^2\ (\Theta - \Theta^1)}{a^2} \right] \right\}$$

$$\int_{o}^{1} e - \frac{\overline{x^1 a}^2}{40c^2\ (\Theta - \Theta^1)}\, dx^1 \times 1.54\ q_F\ (\Theta) \sqrt{\frac{oc^2\ (\Theta - \Theta_1)}{a^2}}$$

The final equation expresses the variations in average reservoir pressure with the oil production obtained over a certain period of time. The constants in the equations, which express the physical properties of the fluids in the Woodbine sand as well as the thickness and properties of the sand itself, are as follows:

c, expansibility of fluids in the Woodbine sand
H, effective thickness of Woodbine sand body
K, average permeability of Woodbine sand body
Φ, porosity of Woodbine sand body

Application to East Texas Field

In order to apply the ideal analysis to the actual East Texas water-drive problem, it was expected that it would be necessary to make certain allowances and corrections for those discrepancies by which the ideal analysis does not fit the actual problem. This was necessary, but it was found that correction for the irregularities could readily be made by adjusting only one constant; namely, the value for the expansibility of the water in the Woodbine sand. The values used for the constants are:

$c = 2.75 \times 10^{-7}$ ft.³ per ft.³ per lb. per sq. ft.
$H = 200$ ft.
$K = 0.035$ ft.³ of fluids flowing per day per sq. ft. of cross-section per lb. per sq. ft. pressure differential per ft. length of flow.
$\Phi = 25$ percent.

The values given for the thickness, permeability, and porosity of the sand are the best estimates that could be arrived at from such laboratory and field data as were available. It is pointed out that by "thickness of sand" is not meant that of the oil reservoir itself, but rather an average thickness of that portion of the water-filled Woodbine sand influenced by production from the field. It is a known fact that the Woodbine sand increases in thickness considerably to the west of the field. The constants for

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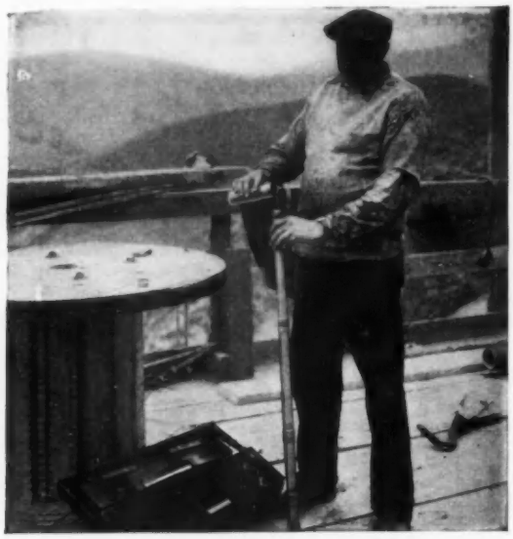

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permeability and porosity have been taken from laboratory determinations on core samples. The adjusted constant used for the expansibility of the water in the Woodbine formation is a little over 10 times the actual value for pure water.

Using the values for the constants as given, the variations in the average reservoir pressure of the East Texas field have been calculated over the very irregular production history of the field. The results are shown graphically as the dashed line in Figure 1, while the actually observed values for the average pressures are the plotted points. It is observed that a close check with the actual data has been obtained. In particular, it is pointed out that the several increases in pressure, observed during periods of shut down or following reduction in the production rate, have been checked by the calculation.

The fact that it has been possible to take care of all irregularities by making an adjustment in only one constant is remarkable, particularly when it is realized that the adjusted value used instead of the expansibility of pure water is not at all unreasonable. It is known that the Woodbine water contains dissolved or occluded gases. Although their exact effect has not been determined, undoubtedly such associated gases would greatly augment the expansive power of the water. In a similar manner the oil and gas fields, scattered throughout the Woodbine basin, would cause the water to behave as though it were a more expansible fluid.

In view of the good check with the actual data and in order to show more clearly the influence of the production rate upon the average reservoir pressure, the changes in the average pressure under several assumed rates of production have been calculated for the year August, 1934, to August, 1935. These results are also given in Figure 1 for production rates of 0; 200,000; 400,000; 600,000; 800,000; and 1,000,000 barrels per day. The curve for zero production rate indicates that the pressure would build up from about 1228 pounds per square inch to nearly 1400 pounds per square inch by August, 1933, if the field were shut in. At a production rate of 400,000 barrels per day, the average pressure would probably remain above 1200 pounds per square inch through August, 1935, but at 1,000,000 barrels per day would decline rapidly to below 1000 pounds per square inch.

It is interesting to compare the predicted average rates of pressure decline expressed as pounds per square inch per million barrels of oil produced for the several assumed rates of production. These figures are given in Table 1.

TABLE 1
Predicted Rates of Pressure Decline

Assumed Rate Bbl. per day	Total Prod. Aug. 1934 Aug. 1935	Predicted Pressure Aug. 1935 Lb. per Sq. In.	Predicted Pressure Change from Aug. 1934 Aug. 1935 Lb. per Sq. In.	Pressure Change Lb. per Sq. In. Million Bbl. Prod.
200,000	73,000,000	1,305	+ 77	+1.05
400,000	146,000,000	1,215	— 13	—0.09
600,000	219,000,000	1,130	— 98	—0.45
800,000	292,000,000	1,035	—193	—0.66
1,000,000	365,000,000	945	—283	—0.78

which shows that the pressure decline during the year per million barrels of oil produced would be over eight times as rapid at a production rate of 1,000,000 barrels per day as at 400,000 barrels per day.

As was pointed out previously, the pressures are being lowered progressively out in the Woodbine sand to the west of the East Texas field. The equations developed have also been used to gain some idea as to the extent

of this decline in pressure. In Figure 4 is shown the calculated pressure gradient for August, 1934, extending from the East Texas field out into the Woodbine formation. The curve indicates that the pressures have been lowered about 125 pounds per square inch at a distance of five miles and, further, that the influence of production from the East Texas field may be felt at a distance approximately 10 miles out in the Woodbine sand.

Conclusions

The data on the East Texas field indicate clearly that water drive or water encroachment is by far the most important agency in maintaining the reservoir pressure or in producing the oil. From the analysis described herein, it appears that the water moves into the field by virtue of its own expansion upon reduction of pressure, and not, as in many cases, by flowing through the entire formation from its surface outcrop to the field. The effect of the expansive power of the water underlying the oil is probably an important factor in a great many oil fields, yet this factor has been overlooked by most geologists and engineers in their investigations of the mechanism of oil production.

The close agreement, as shown in Figure 1, between the calculated behavior of the average reservoir pressure in the East Texas field and that actually observed indicates that the analysis can be used to predict changes in the average pressure over a reasonable period of time. Such calculations have important practical application in the estimation of the flowing life of the field, the determination of the proper rate of production, and similar problems.

The authors are indebted to T. V. Moore, in charge of production research work at Humble Oil & Refining Company, who has directed the work and aided materially in the preparation of this paper.

Nomenclature

P_R = Original reservoir pressure, lb. per sq. in.

P_F = Reservoir pressure at any time, lb. per sq. in.

q_F = Production rate at any time, bbl. per day.

ρ = Density of oil and gas mixture at P, lb. per cu. ft.

K = Permeability of sand, cu. ft. per day per sq. ft. per lb. per sq. ft. per ft.

c = Expansibility of fluids, cu. ft. per cu. ft. per lb. per sq. ft.

Φ = Porosity, fraction

α^2 = Ratio, $\frac{K}{\Phi c}$

Θ = Time, days

a = Half length of field, ft.

x = Distance along coordinate parallel to north-south axis of field

y = Distance along coordinate perpendicular to north-south axis of field.

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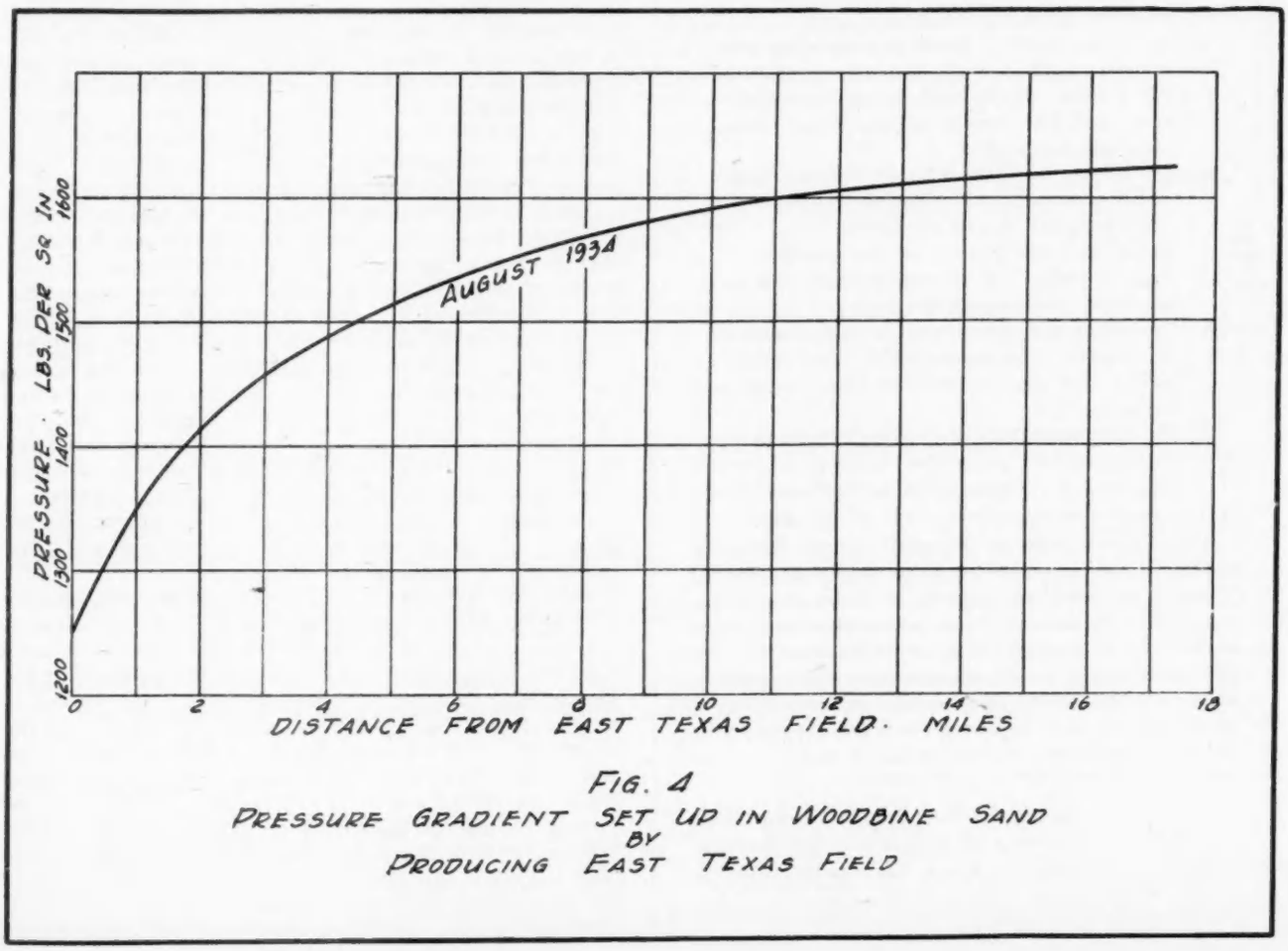


FIG. 4
PRESSURE GRADIENT SET UP IN WOODBINE SAND BY PRODUCING EAST TEXAS FIELD

Some Economic Aspects of Gas Solubility Investigations

STUDIES such as the investigations into the solubility of gases in crude oil under various conditions, which have been carried on during the past three or four years, are very interesting from an academic point of view, but this consideration alone is hardly sufficient to warrant the large contributions from the industry necessary to maintain them. Some definite benefit to the industry as a whole should be forthcoming. The purpose of this paper is to direct the attention of company engineers, and company executives, to some of the ways in which the information gained from these studies can be made directly profitable.

This work has two principal economic aspects. One affects the investment budget, and through it the financial requirements of the companies. The other affects operations, and through this course is reflected in current earnings. It will be shown that, as a direct result of the investigations into gas solubility, undertaken in the recent past by various investigators, it is now possible:

1—To determine more accurately the amount of reservoir oil originally present,

2—To obtain closer control on operating conditions, to effect more economical recovery,

3—To predict earlier and more dependably when and how much surface lifting equipment will be needed,

4—To reduce, or entirely avoid the very large investment in gasoline recovery equipment now frequently found necessary,

5—To control the gravity of the pipeline oil so as to secure the greatest possible revenue from the products of the well,

6—To effect the recovery of a large amount of gasoline now wasted while the practicability of a gasoline recovery system is being decided,

7—To plan operations, by comparison with the history of old properties operated without this new information, so as to avoid the mistakes of ignorance made in the past.

These points will be discussed in the following pages, though not necessarily in the order stated. There is so much overlapping of the points themselves, and of the data from which they have been drawn as conclusions, that to treat them in any particular order would require tiresome repetition of many of the facts presented. It was more practical to present the data in as concise a form as possible, pointing out during its discussion its application to the primary purpose of this paper.

This paper was read before the Petroleum Division, American Institute of Mining and Metallurgical Engineers meeting at Tulsa, Oklahoma, October 12-13, 1934.

ALEXANDER B. MORRIS
Petroleum Engineer, Tulsa, Oklahoma

DURING the past three or four years much time and labor have been expended[1] in efforts to determine the solubility of natural gas in crude oil, under various conditions of pressure and temperature. The early attempts resulted in conclusions which were apparently considerably at variance, and it was not until Lindsly's work[2], with Oklahoma City and several California crude oils that definitely consistent results were attained. Lindsly pointed out that the apparent differences between the findings of these earlier investigators resulted from a failure on their part to duplicate natural conditions by choosing as working media gases containing no condensible components and oils containing none of the lighter fractions, including permanent gases.

By securing well-head and bottom-hole samples of oil with the gas actually in solution at the pressures prevailing at the sampling points, working media were obtained which contained all components, from the lightest to the heaviest, in their natural proportions. By liberating this dissolved gas in pressure steps, and analyzing each cut liberated, it was possible to construct curves for each of the crude stocks chosen, which showed the amounts of the "gas" components remaining in solution at each pressure. Lindsly's results, at the same time that they provide much new material for study, reconcile the varying conclusions of the other investigators in this field by pointing out the reasons for their differences.

The practice of taking bottom-hole samples early in the life of a well, and periodically thereafter, provides information as early as the second sampling, for determining with a degree of reliability never heretofore even approached, the total amount of oil originally present in the reservoir. It provides numerical values for several of the constants in Coleman's formula[3]. The study of cores has had its emphasis changed. The role of porosity as a measure of reservoir space, appears to be less significant than permeability. Pressure studies of the gas released from solution by differential liberation[4] show the amount of natural energy available for recovering the oil; and analyses of the several cuts show the composition of the gas that may be expected to be present in the gas cap at any lower pressure.

With this information it is now possible to appraise a pool within a few months of its opening, determining not only the quantity of oil in the reservoir but obtaining at the same time a guide to development and production programs. The validity of these results is impaired by the presence of water drive as a source of energy; so that where this condition exists, its effect must be compensated for in the calculations. Unfortunately complete information on the extent of water drive is never available until too late in the life of a field to be of any particular value. Where, however, there is no evidence of water drive, Coleman's formula and the values of the constants furnished by bottom-hole sampling yield very satisfactory results. The approximate date upon which wells will cease natural

flow can be closely set for any given production rate, and the production rate resutling in the most economical recovery can be determined. The amount and kind of lifting equipment can be closely estimated long before it is needed, thus avoiding large emergency expenditures to keep the wells on production.

The study of the analyses of the gas released from solution at various pressures below initial reservoir pressure will also reveal when and to what extent a gasoline plant in the field would be practicable. Lindsly's work at Oklahoma City and at Crescent, Oklahoma[2], furnishes data, further discussed below, which indicates that with proper facilities for receiving the oil from the well, a large part or even all of the gasoline plant equipment now generally considered necessary can be avoided.

The ability to make such determinations early in the life of a field is of great value to the executives responsible for providing funds for development and operation. If a sale of an interest in a property is contemplated, estimates of value can be made which are free from many of the elements of uncertainty that now detract from the reliability of such calculations, especially where heavily prorated wells are involved. Where bottom-hole sampling has been conducted, the full results of these tests should be demanded by the prospective purchaser, before his engineers make a recommendation of value. With such data available, a higher price can with safety be paid for prorated new production than would be justifiable in their absence.

It is not necessary here to make a computation from Coleman's formula to show how the estimate of the original oil is prepared. The equation is complicated and the definitions of the quantities are necessarily long. The formula has been adequately illustrated by several numerical examples in the original presentation[3]. Instead, let us consider how bottom-hole sampling coupled with the gas-solubility data thus obtained may be used to govern operations and to predict investment requirements. Table 1 reproduces a part of Table 3 from Lindsly's report[2] on a bottom-hole sample taken at Crescent, Oklahoma. This sample was taken at an original pressure of 2575 pounds per square inch absolute, and the original reservoir pressure was computed to have been 2829 pounds per square inch absolute. Let it be assumed that this sample actually had been taken upon completion of the well, and that the computed initial reservoir pressure had been the pressure actually observed. Let it be further assumed that some months after this initial sampling another sample was taken, at which time the observed bottom-hole pressure had dropped to 2575 pounds per square inch absolute. We would expect to find that the gas-solubility data derived from this second sample would closely check with line 2 of Table 1. If they failed to check within reasonable limits, it would indicate that the liberation of gas from solution in reservoir oil does not approximate differential liberation, as has been stated by Lindsly. Assuming that a check was obtained, the probability that a third test, taken at, say, 2144 pounds per square inch absolute would agree with line 3 of Table 1, obtained from the first sample, would be tremendously increased. A third test at 2144 pounds per square inch absolute would then provide enough points for plotting a "bottom-hole pressure decline curve," using bottom-hole pressure against time and against total withdrawals to date. Extrapolation of these curves would indicate what reservoir pressure might be expected at any date in the future at the present production rate, or after the withdrawal of any stated amount of oil.

TABLE 1

Solubility of Gas and Estimate of Solubility Based on Complete Saturation of Reservoir Oil, at 149°F.

(Portion of Table 3, from Lindsly's Report of Experiments on Bottom-hole Sample at Crescent, Okla.)

	TOTAL GAS		ESTIMATE BASED ON COMPLETE SATURATION AT 2829lb/" ABS.			
Pressure, Lb. per Sq. In. Abs.	In Solution Cu. Ft. per Bbl. Residual Oil	Liberated Cu. Ft. per Bbl. Residual Oil	In Solution Cu. Ft. per Bbl. Initial Oil	Liberated Cu. Ft. per Bbl. Initial Oil	In Solution Cu. Ft. per Bbl. Residual Oil	Liberated Cu. Ft. Bbl. Resid. Oil
2829	.....	.....	642.10	00.00	906.79	00.00
2575	814.03	00.00	589.53	52.17	833.11	73.68
2144	678.99	135.04	492.06	150.04	694.90	211.89
1666	551.87	262.16	399.94	242.16	564.80	341.99
1223	442.95	371.08	321.01	321.09	453.34	453.45
813	319.60	494.43	231.61	410.49	327.08	579.71
354	184.44	629.99	133.37	508.73	188.35	718.44
101	102.62	711.41	74.37	567.73	105.03	801.76
14	00.00	814.03	0.00	642.10	00.00	906.79

Reference to the analyses of the several samples will indicate the amount and composition of the gas remaining in solution at each pressure interval, the available energy of the solution gas, and the composition of the gas in the gas cap. Adequate data are thus available for controlling the rate of production to effect the most economical recovery, and for forecasting the amount and kind of gas-lift or pumping equipment best suited to the needs of the case, and when it will be needed.

No proper operating program would now contemplate tapping the gas in the gas cap, so that a knowledge of the composition of this gas corresponding to various pressures is of no help in determining the practicability of a gasoline plant at some future date. Unfortunately, the experiments that have been made thus far do not show the composition of the gas released by flash liberation[4], between pressure P_m and P_n after the pressure on the oil has been reduced from the original reservoir pressure to P_m, the gas in this range having been liberated differentially. However, there are records[2] of two samples of gas from a well at Oklahoma City, one taken from the high-pressure separator and the other from the low-pressure separator. The conditions of liberation are as shown in Table 2.

TABLE 2

Conditions of Liberation

Pressure Range	Gas from High-pressure Separator	Gas from High-pressure Separator
From initial reservoir pressure to bottom-hole pressure	Differential	Differential
From bottom-hole pressure to well-head pressure, 1103 lbs. per sq. in. abs.	Flash	Flash
From 1103 to 265 lbs. per sq. in. abs.	Mixed	Mixed
From 265 to 16 lbs. per sq. in. abs.		Differential

The well-head pressure was 1103 pounds per square inch absolute, and a pressure of 265 pounds per square inch absolute was held on the high-pressure separator. The oil from this separator discharged into the low-pressure separator, on which a pressure of 16 pounds per square inch absolute was held. Initial reservoir and bottom-hole pressures are not shown, but the latter was probably greater than 2000 pounds per square inch. Examination of the analyses of these gases reveals that the gas from the high-pressure separator contained substantial amounts of propanes and butanes, but that no pentane or heavier component is shown. The gas from the low-pressure separator contained much less methane and ethane, more butane, and substantial amounts of pentane. No fractions heavier than pentane are

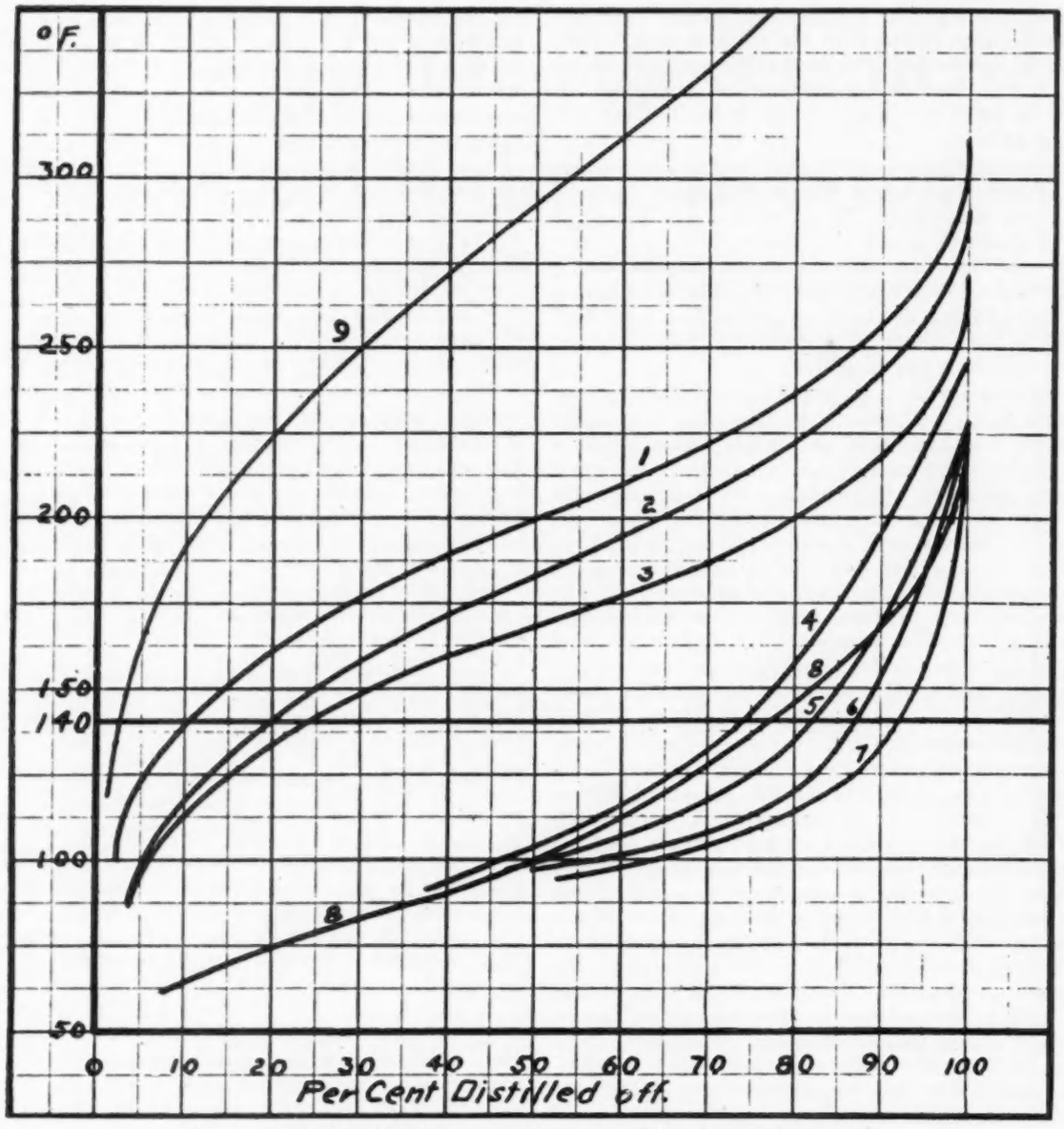


Figure 1—Engler distillation curves corrected for loss at lower end

		Table	Line
1.	Actual run of drip gasoline from Glenn pool, taken from drip 300 ft. from vacuum station	5	4
2.	Actual run of drip gasoline from Glenn pool, taken from drip 1500 ft. from vacuum station	5	4
3.	Actual run of drip gasoline from Glenn pool, taken from drip 1200 ft. further from vacuum station, on same line as yielded curve 1	5	5
4.	Constructed from analysis, gasoline from low-pressure separator gas, Oklahoma City	3	9
5.	Constructed from analysis, gasoline from separator gas, Crescent well	3	2
6.	Constructed from analysis, gasoline from gas differentially liberated from 101 to 14 lb. Crescent well	3	7
7.	Constructed from analysis, gasoline from gas differentially liberated from 283 to 15 lb. Oklahoma City, same well as curve 4		
8.	Actual run of test car make. Gas tested 10.65 gal per min. just after drip gasoline shown in curve 1 came off, and before drip shown in curve 3 came off.	5	8
9.	Actual run of 56.6° A. P. I. straight-run gasoline made from 38° A. P. I. Oklahoma City crude oil. 91 percent off at 391° F.; end point 423° F.		

shown in the published data, but an adjustment has been made for this apparent inaccuracy, as hereafter described.

For the purpose of investigating the bearing of these experiments upon gasoline-plant installation, I have reconstructed from the analyses of the several gases liberated from solution under different pressure conditions, the types of commercial natural gasoline that could be extracted from each, assuming that all components of the gas heavier than iso-butane were completely recovered, and no components lighter than normal butane were recovered. These are shown in Table 3, and the gases from the two separators discussed above are shown on lines 8 and 9. In reconstructing these gasolines it has been assumed that the heaviest component shown in the gas analysis contained also all heavier components up to nonane, in proportion to their vapor pressures at 30°C.; and that the butane component was composed of iso-butane and normal butane in the proportion of 1:2. Only normal paraffin hydrocarbons were assumed to be present.

Table 3, line 8, shows the probable characteristics of the gasoline extractible from the gas from the low-pressure separator at this Oklahoma City well, assuming that all the N-butane present in the gas was condensed. This is not a commercial product, but by reducing the N-butane content to 25 percent by weight, a product having the probable characteristics shown in Table 3, line 9, is obtained. An approximation of the Engler distillation curve of such a gasoline is shown in Figure 1, curve 4. This distillation curve and others prepared from similar analysis data have been constructed by reference to Oberfell's[6] analysis chart for natural gasolines.

Table 3, lines 10 and 11, show the characteristics of the

TABLE 3

Comparison of Computed Properties of Iso-Butane-free Natural Gasolines Which Might be Extracted from Gases Liberated from Solution under Various Pressure Conditions

	Gal. per day	M. Cu. Ft. per day	Gal. per M. Cu. Ft.	Gravity Deg. A.P.I.	Approx. Vapor Press. at 100°F Lb. per Sq. In.	Percentage by Liquid Volume				
						N-Butane	Pentane	Heavier	Hexane and Percent Distilled Off	
									At 100°F.	At 140°F.
Crescent Well 42.1° A.P.I. Oil										
Separator Gas, Well Head Pr. 950 lb. Separator Pr. 30 lb. per sq. in. abs.										
1. Using all N-butane in gas	1,672	466	3.58	98.2	32.54	47.2	31.7	21.1	72	87
2. N-butane reduced to 25 percent wt	834	466	1.79	93.1	24.75	27.0	43.8	29.2	51	82
Gas from bottom-hole sample Liberated above 101 lb. per sq. in. abs.										
3. Using all N-butane in gas	277	342	0.81	107.9	44.13	90.9	7.2	1.9	cannot estimate	
4. N-butane reduced to 25 percent wt	9	342	0.026	95.2	18.96	26.9	57.0	16.1	cannot estimate	
5. Another gasoline	17	342	0.049	100.4	24.93	51.5	37.3	11.2	cannot estimate	
Liberated between 101 lb. per sq. in. abs. and 14 lb. per sq. in. abs.										
6. Using all N-butane in gas	411	50	8.21	98.6	33.30	48.4	33.5	18.1	77	91
7. N-butane reduced to 25 percent wt	196	50	3.91	94.1	24.30	26.8	47.3	25.9	57	87
Well "D" Oklahoma City 43° A.P.I. Oil										
Low Pressure separator gas, 16 lb. per sq. in. abs.										
8. Using all N-butane in gas			2.31	99.3	36.18	56.2	23.2	20.6	cannot estimate	
9. N-butane reduced to 25 percent wt			0.78	93.1	23.72	26.9	38.8	34.1	46	74
Gas from well-head sample, differential liberation 283 to 15 lb. per sq. in. abs.										
10. Using all N-butane in gas			2.44	102.3	38.38	60.7	27.5	11.8	cannot estimate.	
11. N-butane reduced to 25 percent wt			0.65	94.9	24.60	26.8	51.5	21.7	64	92
12. High pressure separator gas, 265 lb. per sq. in. abs.	*					Contains only traces of pentane and heavier.				

*Very high gas-oil ratio, possibly as high as 10,000 cu. ft. per barrel, due to pressure of much excess free reservoir (?) gas.

gasoline which might be extracted from the gas from this same well, released by differential liberation between 283 pounds per square inch absolute and 15 pounds per square inch absolute, after the gas had been released by flash liberation between a bottom-hole pressure of 2000 pounds per square inch, more or less, and a well-head pressure of 1103 pounds per square inch absolute, and differentially from this latter pressure down to 283 pounds per square inch absolute. The product obtainable from this gas if all the N-butane in the gas is condensed is not a commercial product (line 10), but by reducing the N-butane content to 25 percent by weight, a commercial product of characteristics shown in line 11 is obtained. An approximate distillation curve for such a gasoline is shown in Figure 1*, curve 7.

It is interesting to note the difference between the gasoline that might be extracted from the low-pressure separator (Table 3, line 9) and that which might be extracted from the gas from the sampling bomb (Table 3, line 11). When flash liberation extended all the way down to 265 pounds per square inch absolute, the gas escaping from solution between 265 and 16 pounds per square inch absolute would produce a commercial gasoline of approximately 24 pounds vapor pressure having 34.1 percent by liquid volume of hexane and heavier components. When differential liberation prevailed throughout the entire range of pressure drop between well-head pressure and atmosphere, the resulting gasoline having approximately the same vapor pressure would contain only 21.7 percent by liquid volume of hexane and heavier components. The net yield, in gallons per 1000 cubic feet of each of these products is about the same: 0.78 gallon per 1000 cubic feet for the separator gas, and 0.65 gallon for the bomb gas, but differential liberation resulted in retaining in the oil sufficient hexane and heavier material to reduce the percentage of these components in the gasoline from 34.1 to 21.7 percent.

Table 4 shows the results of analyses of gas from the separator and from the bottom-hole sampling bomb at the well in the Crescent field. The data on the separator gas were furnished by the operator. The data on the bomb gas were taken from Lindsly's[5] paper on these experiments. There was approximately 24 percent more gas per barrel of oil escaping from the separator than was released by differential liberation from the bottom-hole sample. Since it is unlikely that any free reservoir gas was escaping from the well, this difference may be in part accounted for by the fact that the gas-oil ratio attributed to the separator gas was determined from field measurements of both gas and oil, which are not as accurate as the careful laboratory measurements to which the bomb sample was subjected. Table 3, lines 1 to 7, set forth the probable characteristics of gasolines extractible from the gas from this well under different conditions of liberation from solution. If all the N-butane in the separator gas is condensed a large quantity of a very wild product is obtained (Table 3, line 1). If the N-butane content of this gasoline is reduced to 25 percent by weight, a commercial product (Table 3, line 2) is obtained, having 29.2 percent by liquid volume of hexane and heavier components. When differential liberation is applied throughout the entire pressure range, the gas liberated between 101 and 14 pounds per square inch absolute yields a commercial gasoline having 25.9 percent by liquid volume of hexane and heavier; but the quantity of this gasoline is less than one quarter of that obtained from the separator gas. Thus differential liberation throughout the entire range from bottom-hole pressure to atmosphere has resulted in retaining in the oil 79 percent of the hexane and heavier components which were removed from solution in the oil by flash liberation of the gas. Approximate distillation curves of these two gasolines are shown in Figure 1, curves 5 and 6. The gas released by differential liberation above 101 pounds per square inch absolute yielded only traces of any kind of gasoline (Table 3, lines 3, 4 and 5).

Mills and Heithecker[3] have shown that the gravity of crude oil can be substantially increased by increasing the amount of gas dissolved in it; and Lindsly has found that differential liberation of gas over a wide pressure range, by retaining in solution more of the lighter liquids while the fixed gases are removed, results in raising the gravity of the residual oil—that is, the oil in tanks—by from 1° to 3° A. P. I. Whereas it is not possible in practice to subject bottom-hole oil to differential liberation throughout the entire pressure drop, it is possible to approximate these conditions by multiple trapping. Thus, two separators can be installed at a well, which produces under single trapping, oil having a gravity of, say, 38° A. P. I. If the pressure on the high-pressure separator is carried at about 200 pounds and that on the low-pressure separator at about 10 pounds,

TABLE 4

Analyses of Gas Released from Solution Under Different Pressure Conditions, Well at Crescent, Oklahoma

Component	GAS FROM SEPARATOR[1]		BOMB GAS—DIFFERENTIAL LIBERATION[2]					EXCESS OF SEPARATOR GAS OVER BOMB GAS		
			Released							
	Percent by Volume	[3]Cu. Ft. per Bbl. Residual Oil	Above 101 Lbs. per Sq. In. Abs.	Between 101 and 14 Lbs. per Sq. In. Abs.	Total	Cu. Ft. per Bbl. Residual Test Oil Conditions	Corrected to 60° F. 14.65 Lbs. per Sq. In. Abs.	Cu. Ft. per Bbl. Residual Oil	Composition Percent	Gasoline Fraction
O, N, and CO_2	0.0158	17.1	0.0158	0.00000	0.0158	14.32	13.81	3.29	0.0149	.....
CH_4	0.6850	739.8	0.72763	0.00996	0.73759	668.85	645.04	94.76	0.4294	.....
C_2H_6	0.0677	73.0	0.06231	0.03852	0.10083	91.43	88.18	(15.18)	.....	.....
C_3H_8	0.1045	112.9	0.03053	0.03902	0.06955	63.07	60.82	52.08	0.2360	.....
Iso-Butane	0.0226	24.4	0.01048	0.00812	0.01860	16.87	16.26	8.14	0.0369	.....
N-Butane	0.0546	59.1	0.02097	0.01625	0.03722	33.75	32.55	26.55	0.1203	0.1203
C_5H_{12}	0.0319	34.5	0.00586	0.00971	0.01557	14.11	13.61	20.89	0.0948	0.0948
C_6H_{14}	0.01251	13.4	0.00030	0.00316	0.00346	3.14	3.03	10.37	0.0470	0.0470
C_7H_{16}	0.00392	4.2	0.00005	0.00098	0.00103	0.93	0.90	3.30	0.0149	0.0149
C_8H_{18}	0.00124	1.3	0.00001	0.00031	0.00032	0.29	0.28	1.02	0.0046	0.0046
C_9H_{20}	0.00033	0.3	.....	0.00003	0.00003	0.03	0.03	0.27	0.0012	0.0012
TOTALS.....	1.0000	1080.0[3]	0.87394	0.12606	1.00000	906.79	874.51	220.67	1.0000	0.2708

[1]Operator's records, measured at 60° F. and 14.65 lb. per sq. in. abs. Hexane and heavier component assumed to contain compounds in proportion to their vapor pressures at 30°C.

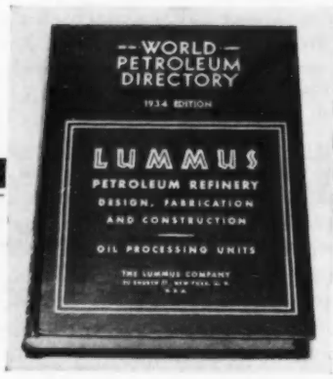
[2]Lindsly, Ben E., Experimental Results from a Bottom-hole Sample, Crescent Pool, Oklahoma, measured at 70° F. and 14.4 lb. per sq. in. abs. Hexane and heavier component broken down as above.

[3]Operator reports gas-oil ratio as 1080 cu. ft. per barrel based on tests prior and subsequent to experiment. Lindsly records approximately 900 to 1000 cu. ft. per barrel. Gas from separator shows 24 percent more volume than gas released from solution by differential liberation on basis of operator's records; 14 percent more on basis of Lindsly's records. Of excess of separator gas over bomb gas, 27.08 percent is N-Butane and heavier.

very little, if any, of the pentanes and heavier components of the gas-oil mixture will escape in the gas discharged from the high-pressure separator. See Table 3, lines 3, 4 and 5. The result is that more of them will be left in solution when the oil is discharged from the low-pressure separator. Such a procedure might readily raise the gravity of the oil more than 1 A. P. I. and mean considerable additional revenue to the property. However, if the gravity of the oil under single trapping is already above 40° A. P. I., there is no advantage in retaining still more of the lighter components in solution. It would be better to weather off the crude to a minimum gravity of 40° A. P. I. and sell the vapors thus produced to a gasoline plant, thus gaining revenue from the part of the original crude for which no premium is paid under present schedules.

An adaptation of multiple trapping is suggested in Figure 3, in which an old bubble-type absorber is shown substituted for the low-pressure separator. The oil from the high-pressure separator is discharged into the inlet port of the absorber, into the top of which some of the gas from the high-pressure separator is expanded to furnish refrigeration. An old oil-field type boiler forms the kettle for this stabilizer, and permits the oil to be heated if necessary. Enough pressure is assumed to be held on the absorber to throw the stabilized oil into the stock tanks. The remainder of the high-pressure gas is disposed of without further treatment, and the gas from the top of the absorber is delivered to the gasoline plant for treatment. This arrangement would cost very little, since nearly all companies have idle absorption equipment and old boilers on hand; and it would result in the delivery to the pipe line of a crude oil from which all of the permanent gases had been removed. The vapors thus made available for gasoline extraction will contain a much greater percentage of hexane and heavier components than where ordinary double trapping is in practice. Such vapors, sold to an outside gasoline plant, would command a higher royalty rate than could otherwise be obtained; and it is probable that even the gas from the low-pressure separator, where two are used, would command a higher rate of royalty than well-pressure gas. Thus even the operator who has not sufficient production in a field to warrant the installation of his own gasoline plant can derive some benefit from the reduced investment necessary on the part of the owner of the gasoline plant.

One of the most regretable sources of waste in the early development of a property is the enormous volume of gas that is often vented to the air without treatment, while the management is trying to decide how large a gasoline plant to install, or whether or not to install one at all. Often from one to three years is required to reach this decision. There is always a great risk in building a gasoline plant in a new field, in that, if it is built to handle all the gas available in the flush period of production, a large part of this investment will be idle after this period has passed. A system of multiple trapping, or the stabilizing adaptation



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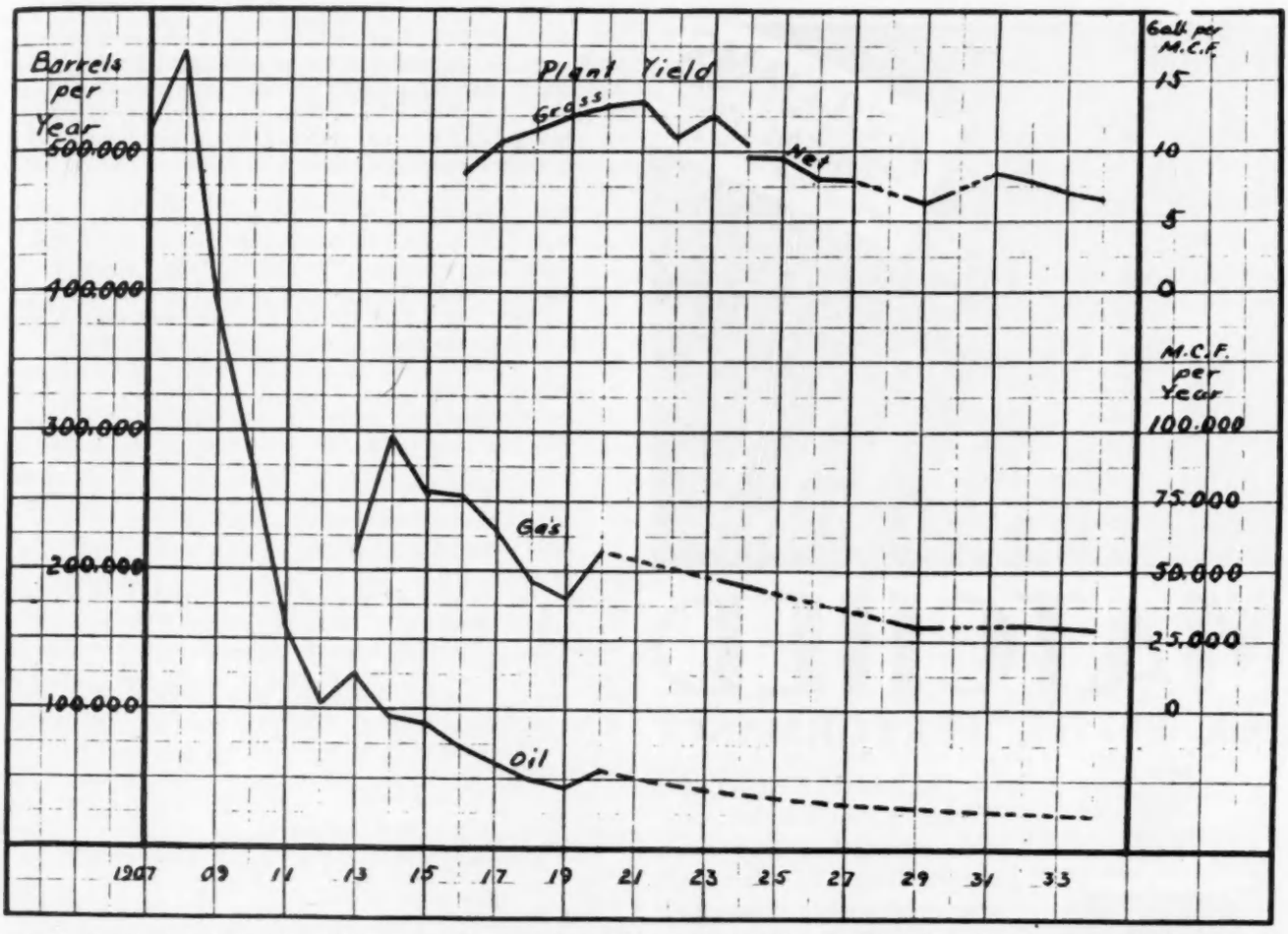


Figure 2—Partial Production History of Glenpool Lease from which Drip Gasoline Samples shown in Table 2 were obtained. Plant Yield Curve is from gasoline plant running gas from this lease along with other Glenpool gas. Note increase in plant yield and subsequent decrease, indicating complete exhaustion of light fractions.

here suggested, would solve this dilemma. Small gasoline extraction equipment could be installed very early in the life of the field, designed to treat only the gas discharged from the low-pressure separators. As conditions changed with declining production and gas volumes, and it became no longer feasible to continue double trapping, all the gas could then be turned through the plant. By this time, however, the total volume of gas would probably not be greater than could easily be handled with the plant already in place, so that all of the investment in gasoline-extraction equipment could be kept active throughout the period of its existence; and all the gasoline that now is wasted to the air from new properties could be saved without risk of overbuilding the gasoline plant.

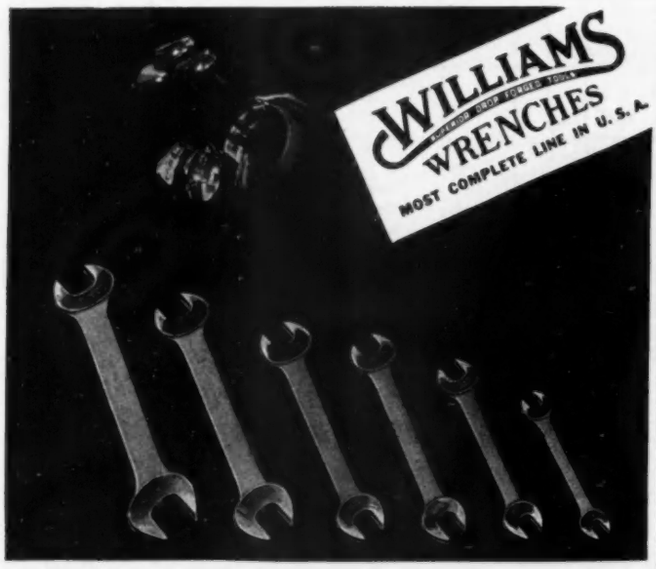
Royalty owners, lease operators and gasoline manufacturers would thus benefit directly and largely. It is a curious fact that the large quantities of gasoline that are allowed to escape during the early life of a field are viewed with so little concern, whereas very substantial sums are continually being expended in improving plant recovery efficiency to effect an increase in recovery negligible in comparison.

A much greater reduction in gasoline recovery facilities is possible than is indicated by the consideration of gas volumes alone. In absorber design provision has to be made for absorbing all the propanes and iso-butane from a mixture very rich in methane and ethane. The low-pressure separator gas contains relatively small amounts of methane and ethane, so that the propanes and the iso-butane are in higher concentration. Oil circulation, still and dephlegmator capacity and cooling capacity can therefore be still further reduced.

Another possibility that is suggested by the arrangement shown in Figure 3, which would be practicable as long as there was a considerable volume of gas being discharged from the high-pressure separator, is the use of this gas to drive a compressor operating upon the gas from the low-pressure separator or the crude stabilizer. The high percentage of propanes and iso-butane in the low-pressure gas would make this peculiarly suited to vapor-phase stabilization. The expansion of the surplus high-pressure gas would provide refrigeration for knocking back the propanes for reflux purposes, and the heat of compression of the low-pressure gas would probably supply all the heat needed to operate the system. A gasoline plant of this nature could be installed at very small cost, as soon as sufficient gas became available to run one unit; and would represent a still further reduction in gasoline recovery equipment below the present conventional minimum.

In further illustration of the points raised by these solubility investigations, there are submitted some data dealing with a lease in the Glenn Pool, in Creek County, Oklahoma. Figure 2 gives a partial production history of this property. It is a lease of 160 acres in the central part of the field, and was fully developed prior to 1910. Vacuum was applied in 1913, and in 1928-29 approximately 26 inches of vacuum had been held on the wells for upward of 12 years. Production conditions have been practically uniform throughout the whole field for many years. The "plant yield" curve shown on Figure 2 is the yield of the gasoline plant in the field, which took the gas from this lease along with about 20 times as much more gas from other nearby leases.

The most interesting point developed from Figure 2 is



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the shape of the "plant yield" curve. The gas from this field increased in richness for several years after vacuum was applied, and then rapidly declined from a peak of about 13 gallons per 1000 cubic feet to a present rate of a little over six gallons per 1000 cubic feet. In the light of the recent studies under discussion, this condition would indicate:

1. The exhaustion of the original gas in the gas cap above the oil. This gas was released from solution differentially, and contained relatively large amounts of methane and ethane. As it was withdrawn from the gas cap, subsequent increments contained greater and greater proportions of the heavier components.
2. The removal from the reservoir oil of a large amount of the lighter fractions, which would have remained in solution at the reservoir temperature had not vacuum been applied.
3. The exhaustion from all the remaining oil of practically all of the permanent gases, so that the proportion of the heavier components which these gases will carry away from a heavy oil mixture is severely reduced.

During the period of declining plant yield in this field there was observed a growing disparity between the theoretical gallons indicated by the sum of the products of the test yields at the various meters by the corresponding gas volumes, and the theoretical gallons indicated by tests at the plant master meter. The field tests were always in excess of the master meter test, and this difference was not compensated for by the collections of drip gasoline. This condition led to the study in which the drip gasoline data offered in Table 5 were collected.

In Figure 1, curves 1, 2 and 3 show actual Engler distillations of three samples of drip gasoline collected on one day from three drips on the Glenn pool lease referred to above. Curve 8 is a distillation of the test-car make from gas from the "A" wells. Approximate analyses of these gasolines, inferred by reference to Oberfell's analysis chart, are shown in Table 5, lines 4, 5, 6 and 8. This gas was tested at a point about 300 feet from the vacuum station, and about 10 feet downstream from the drip wherein was collected the drip gasoline shown in Figure 1, curve 1. The test at this point was 10.65 gallons per 1000 cubic feet. About 1200 feet farther downstream from the test point, was located the drip from which the sample shown in Figure 1, curve 3, was collected. The upstream sample was too heavy to have its characteristics included within the limits of the analysis chart for natural gasolines. The downstream sample was just light enough to fall on the chart, and an approximate analysis is given in Table 5, line 5. The drip gasoline shown in Figure 1, curve 2, Table 5, line 6, was obtained from a drip located about 1500 feet from the vacuum station serving the "B" wells on this same property.

These analyses and distillation curves show the kind of material that is being pulled out of the Glenn pool crude as a result of the long-continued application of high vacuum. The gravity of the crude from this field has dropped from about 38° A. P. I. in the early life of the field to between 33° and 34° A. P. I. at present. These samples of drip gasoline condensed in the line at 10 inches of vacuum and at 45° F. The value of this liquid to the operator is greater as crude oil than it is as natural gasoline. This condition has prevailed for several years, and bids fair to continue. Were the Glenn pool being developed in 1934, instead of having been developed in 1908, it is hardly likely that an investigator in 1960 would find that the drip gasoline that was then condensing in the lines would have an initial boiling point of 100° F. and over.

A comparison of the inferred analyses[6] of this drip gasoline produced by wells long subjected to high vacuum

TABLE 5

Distillation Characteristics and Inferred Analyses of Some Drip Gasolines from a Property in Glenpool, Oklahoma, with Some Data on Gas in that Field

LINE	Gal. per Day (1)	M. Cu. Ft. per Day (1)	Gal. per M. Cu. Ft. (1)	Gravity Deg. A.P.I. (2)	Percentage By Liquid Volume: Butanes Pentane Lighter (4)	(4)	Hexane and Heavier (4)	Percentage Distilled Off: At 100°F. (2)	At 140°F. (2)	End Point Deg. F. (2)
Gas going to gasoline plant from lease:										
1. Group "A" wells	552	53.4	10.33							
2. Group "B" wells	408	46.7	8.73							
3. Total	960	100.1	9.59							
Drip gasoline(3)										
4. From "A" wells: Caught 300 ft. from vacuum station	56			66.3	cannot estimate from cart			0	11.0	313
5. Caught 1500 ft. from vacuum station	107			70.8	9.0	17.7	73.3	6	24.5	292
From "B" wells:										
6. Caught 1500 ft. from vacuum station	219			70.4	11.0	16.9	72.1	6.5	20.0	272
Total drip gasoline	382									
7. Total gasoline from lease	1,342									
8. Test-car make gas from "A" wells tested 310 ft. from vacuum station			10.65	87.0	28.5	39.0	32.5	50.0	77.5	236

Initial gravities of oil in Glenpool, 38° to 39° Be. Gravities in November, 1927, 33° to 35° A.P.I. This lease yielded 11,900 gallons of drip gasoline in the month of November, 1927.

[1]Plant records, field measurements of gas, and actual settlement test of gas.

[2]Special distillation tests of drip gasoline, Jan. 1928.

[3]Special gages of drip gasoline from this lease, Nov. 1927. Drip condensed at 45° F. and 10 in. of vacuum from gas drawn from wells at 26 in. vacuum.

[4]Inferred analyses using Oberfell's analysis chart for natural gasolines.

Table 5, with the analyses of the reconstructed gasolines made from gas from wells still under high natural pressure, Table 3, shows the very high percentage of hexane and heavier fractions, 73 percent in the drip gasolines as compared to 29 to 34 percent in the others. The distillation curves of these two groups of products form two distinct groups on Figure 1. It is interesting to note that the test-car make, Figure 1, curve 8, from Glenn pool gas displays a distillation curve closely agreeing with the curves of the lighter group. The wide spread between the distillation curves of these two groups bears out the findings of the recent studies, pointing to selective solubility.

There is still much work to be done along these lines, which may be counted upon to be well worth its cost in money and effort; and it is hoped that this paper will suggest some new points for future investigation, as well as fulfill its patent purpose of pointing out the advantages already accrued.

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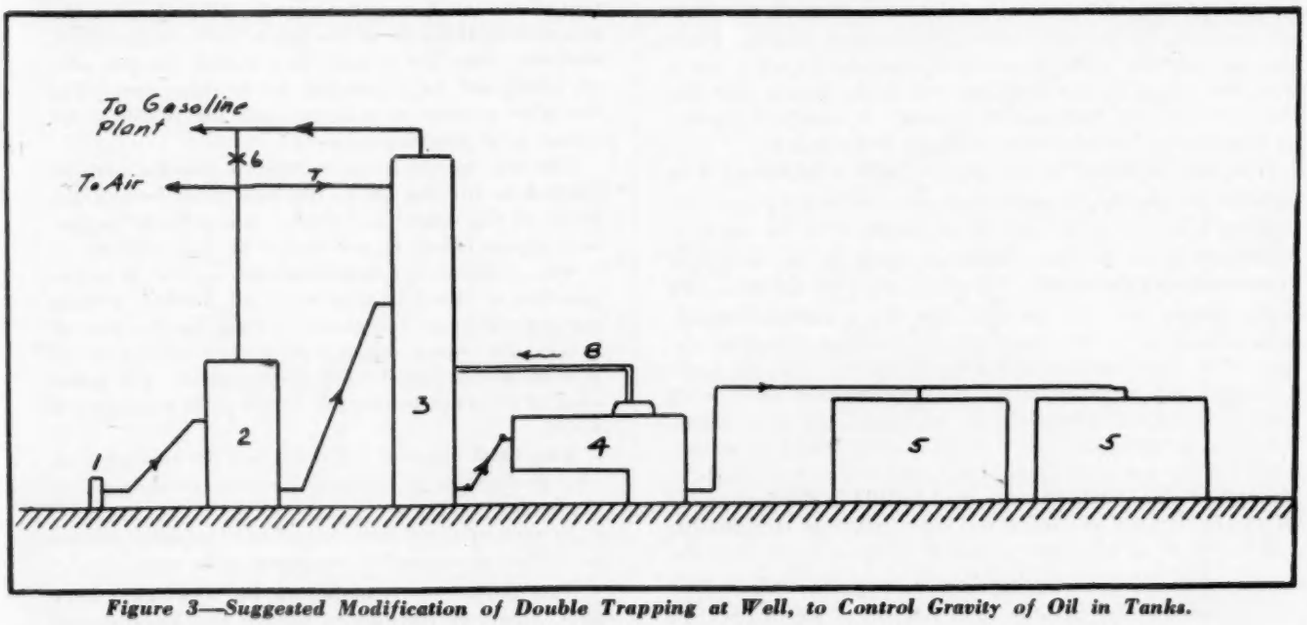

Figure 3—Suggested Modification of Double Trapping at Well, to Control Gravity of Oil in Tanks.

1. Well head.
2. High pressure separator.
3. Bubble-type absorber, for stabilizer.
4. Oil field type boiler for stabilizer kettle.
5. Stock tanks.
6. Gate on by-pass.
7. High pressure gas line to top of stabilizer.
8. Vapor line from kettle to stabilizer.

Energy Relationships *in the* Oil Bearing Formation

JAN VERSLUYS

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ASSUME a basin in which the layers show a closed exposure, part of the layers being sandy, while the others are perfectly tight shales. The sandy beds persist with the same thickness throughout the basin. Water then fills the pores of the sands very close to the outcrop at all points. This condition is maintained by atmospheric precipitation.

Because of gravity the water at a point A of the outcrop, Figure 1, has a potential energy of $h_a\gamma$ per unit of volume with respect to an arbitrarily chosen horizontal plane of origin if h_a is the altitude of A with respect to this plane and γ the specific gravity of the water. In the same way the unit of volume has a potential energy of $h_b\gamma$ at B. If the unit of volume of water were transposed from A to B it would have lost a potential energy $(h_a—h_b)\ \gamma$. So gravity performs work when water flows from one point of the layer to another, which means that a condition of flow prevails. Thus, generally speaking, it can be said that water penetrates the sand at the higher portions of the outcrop and flows out at its lower portions. The motion is so slow that kinetic energy may be neglected.

In the outcrop the water bears no potential energy other than that due to gravity. In other parts of the sand, however, the potential energy may be greater than that of gravity. The water may, for instance, flow from a point C (see Figure 1) to B, which lies higher. So there must be more energy per unit of volume of water at C than at B, which is manifested by a certain hydrostatic pressure. Hence at any point of the sand which is not in the outcrop the water has a potential energy in excess of that due to the gravity and this excess causes the hydrostatic pressure. It causes the water to rise in a well and may be called the pressure head.

If a well is drilled at the point C, with a permeable wall opposite the face of the sandy layer, the water will rise in the well to a certain point, say D in Figure 1, if no liquid is withdrawn from it. The column of water in the well then counterbalances the pressure H_c of the water in the sand. The water at any point in the sand thus has a potential energy, with respect to a horizontal plane of origin, which is the sum of its energy due to pressure and gravity. One can speak therefore of the potential of the subterranean water with respect to an arbitrarily chosen horizontal plane of origin, which is the height to which it can rise in a well above this plane. The expression "potential," which has been used by the author[2] since 1911, was also used in 1914 in the first report of the Interstate Commission on Artesian Water in Australia.

Thus there is a certain potential p, at each point in the sand, and this may be expressed by a function $p_1 = f_1(x, y, z)$ of three rectangular coordinates x, y and z, of which z will be chosen for the vertical.

The pressure in a well, drilled at C (Figure 1), may be lowered artificially, so that the potential of the water in the

WHEN the oil is recovered from the subterranean sand energy is required for two purposes: (1) to transport the oil through the sand towards the wells, (2) to lift the oil from the depth of the oil-bearing layer to the surface of the ground.

In every field natural sources of energy are available. The most important sources of energy are: (1) what the author since 1914 has called the "potential" of the liquid in the ground, and (2) the energy due to the presence of gas under high pressure, partly or altogether dissolved in the oil. Both sources of energy contribute to the propulsion of the oil towards the wells as well as to the lifting of the oil.

It will be shown in this paper that the first named source of energy as a rule would suffice to do the work for both the horizontal transportation and for the lifting, provided the field were produced at an infinitely slow rate (farther on the reader will see that this lifting, as in the case of an artesian well, might raise the oil to some tens of meters above the surface of the earth). If the oil is recovered at a faster rate, this source of energy only suffices to supply the work for the horizontal transportation and to lift it to a certain level, which lies below the surface of the earth. The energy of the gas then may be utilized to lift the oil on up to the surface of the earth, but sometimes extraneous energy is invoked, as in pumping or in gas-lifting. The energy of the gas is also an aid in the horizontal transportation of the oil, but, as the author will prove, the importance of this role of the gas is often exaggerated. However, there are reasons to conserve the gas, part of which will be elaborated on in this paper. For the other reasons to conserve gas, the reader is referred to a previous paper[12].

The way in which the energy of the gas may be utilized to lift the oil to the surface is beyond the scope of this paper and readers are referred to former papers issued by the author on this subject[1].

The problems are very intricate, so that it is impossible to do full justice to all factors without making the paper indigestible. Thus for the sake of brevity the author will refrain from touching on all possible factors involved in the problem. The inference of the conclusions will be given in a condensed form.

Two ideal cases of oil fields will be treated first, viz. production by *water-drive* and production by *depletion*.

In each of these cases one of the two main sources of energy mentioned is supposed to be zero.

This paper was read before the Petroleum Division, American Institute of Mining and Metallurgical Engineers meeting at Tulsa, Oklahoma, October 12-13, 1934.

sand at the perforated wall of this well is decreased. This condition can only be established by withdrawing water from the well. A new condition then arises in the sand, which is expressed by a potential $p_2 = f_2(x, y, z)$ for each point x, y, z in the sand, which has a value p_2 within the well. This condition is maintained by withdrawing a certain volume of water Q_2 per unit of time from the well.

Suppose the variation of potential caused by this withdrawal of water is $P = F(x, y, z)$

so that $P = p_1 - p_2$ or

$$F(x, y, z) = f_1(x, y, z) - f_2(x, y, z)$$

For the perforated wall of the well, the magnitudes p_1, p_2 and P will be written p_1', p_2' and P'.

The flow of water through sand follows Darcy's[2] law, which is Poiseuille's law applied to the pores of the sand. Consequently Laplace's equation holds good for the flow of water in sands in the same way as it does for the conduction of electricity and heat. Hence Dirichlet's principle is applicable to the motion of water through the layer[3].

For p_1 and p_2 each three conditions can be written directly concerning these potentials as well as their first and second derivatives. From these conditions similar ones can be derived for P because $P = p_1 - p_2$.

The first condition is that the potentials p_1 and p_2 satisfy Laplace's equation. The other conditions concern the behavior of the potential at the boundaries; viz., second, that in the outcrop the potential equals the altitude, provided both are expressed in the same units of length and measured from the same horizontal plane of origin, and third that the flow in the planes of contact with impervious layers in the direction of the normals N of these planes is zero. Moreover, there is a fourth condition for p_2; viz., that in the well it is equal to the potential p_2' induced there. From these conditions, which are satisfied by p_1 and p_2, follow conditions for P_1, because $P = p_1 - p_2$.

So the following conditions can be written:

	For p_1	For p_2	For P
1.	$\Delta p_1 = 0$	$\Delta p_2 = 0$	$\Delta P = 0$
2. In the outcrop:	$p_1 = z$	$p_2 = z$	$P = 0$
3. In the planes of contact	$\frac{\partial p_1}{\partial N} = 0$	$\frac{\partial p_2}{\partial N} = 0$	$\frac{\partial P}{\partial N} = 0$
4. In the well:	$p_1 = p_1'$	$p_2 = p_2'$	$P = p_1' - p_2' = P'$

In this table p_1' is the value of potential at the perforated wall of the well before withdrawal of liquid had commenced and p_2' the value to which this potential changed when a volume of liquid Q_2 per second was withdrawn from the well.

The four conditions in the right-hand column of the table are derived from those in the first and second columns. These four conditions of the right-hand column determine $P = F(x, y, z)$. The variation of the potential in each point of the formation is induced by the withdrawal of water from the well. From these it follows that the variation of potential in each arbitrary point of the layer is dependent on the artificial variation of potential, and therefore of the pressure induced in the well, the shape of the exposure and of the planes of contact, but that it is independent of the original potential at the exposure.

An important conclusion may be derived from this independence of the conditions prevailing originally. Any other function expressing the distribution of the potential at the outcrop which would cause a potential, say $p_2 = f_2(x, y, z)$, will undergo the same variation $P = F(x, y, z)$, if within the well the same diminution as before is induced. This holds good if $p_2 - f_2(x, y, z)$ is such a condition that the potential is the same throughout the outcrop, which means that the liquid is at rest. The outcrop then would be a horizontal plane. The potential p_1' within the well then would equal the potential or the altitude of the outcrop. In this case a diminution P' would change the condition of rest into a condition of flow, which would be expressed by the function $P = F(x, y, z)$.

As a rule the dip of the strata as a whole is so gentle that the assumption that the horizontal distance may be substituted for the distance measured along the strata is warranted.

Thus, the variation of potential throughout the formation caused by a diminution of potential, and therefore pressure induced in the well, depends only on the value of this diminution and the horizontal extension of the layer from the well in all directions.

That the variation of the potential is independent of the

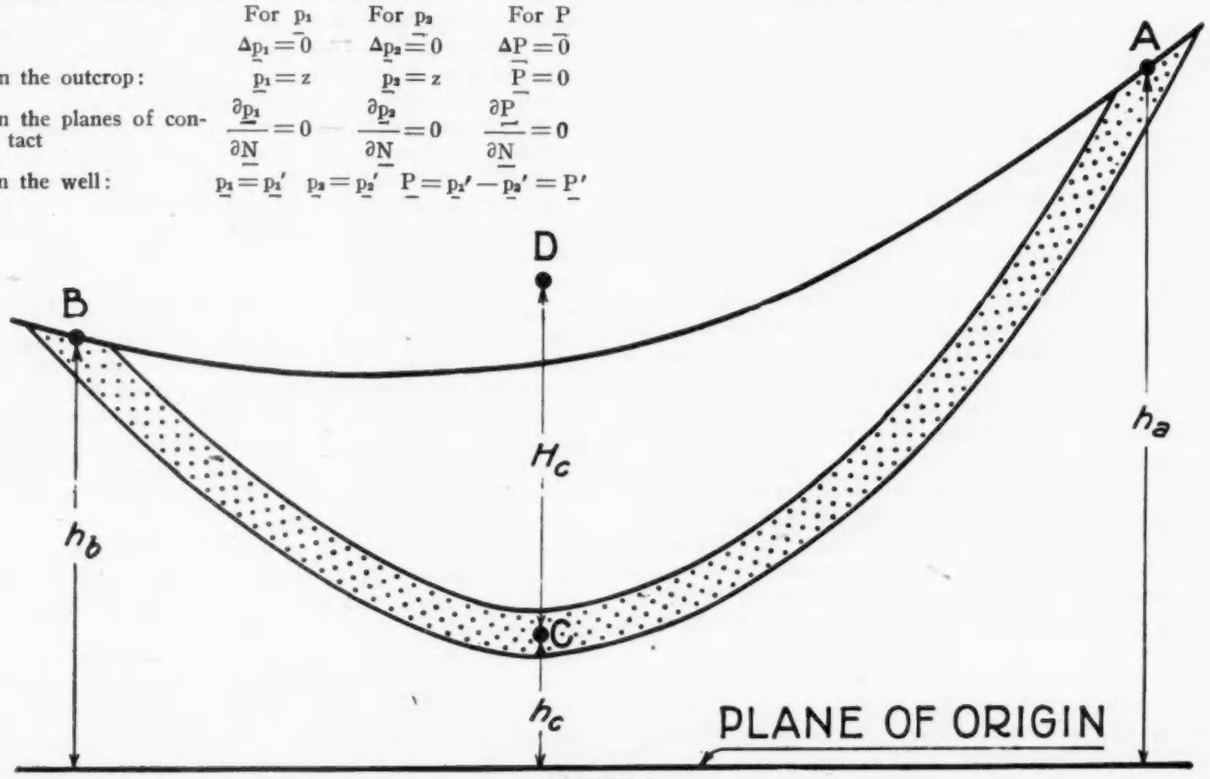


FIGURE 2

original condition also implies that if a diminution of potential is first induced in the well at C, which causes a variation P throughout the sand, and this is repeated n times, the final variation in the well will be n P^2 and at each point in the sand n P, so that the variation in each point is proportional to the value of the diminution induced in the well.

From these two rules: (1) that the variation of potential caused in any point of the formation by a diminution of potential, and therefore of pressure induced in the well, is independent of the originally prevailing condition, (2) that this variation is proportional to such a diminution, it follows that the volume of liquid withdrawn per unit of time from the well is proportional to the diminution it causes.

The volume withdrawn per unit of time is

$$Q = K \int_0^{\tau} \frac{\partial P}{\partial N} \partial \tau$$

Where τ is the area of the perforated surface of the well and the distance along the normal of this surface, and K is the coefficient of Darcy's formula. Thus if K and τ are constants, Q is proportional to P'. If the well has penetrated the layer to the bottom and is perforated over the whole thickness of the sand the value of Q is proportional to the thickness of the layer.

So that the following expression may be written:

$$Q = cP' \qquad (1)$$

Where c is a factor proportional to K and the thickness of the layer, and furthermore dependent on the horizontal extension of the layer.

The level to which the liquid is able to rise at a given point will be called the "potential level." If liquid is withdrawn from a well at such a rate (Q units of volume per second) that the potential at the bottom is decreased P', then the useful work required for pumping a unit volume to the potential level is:

$$w = \gamma P' \qquad (2)$$

and in accordance with formula 1,

$$w = \gamma \frac{Q}{c} \qquad (3)$$

so that the artificial lifting work required per unit of volume is proportional to the rate of production.

The potential of the liquid is able to lift it to the potential level without any additional supply of extraneous work, but for a finite volume an infinite time is then required. The faster the rate of production, the more extraneous work is required per unit of volume. This means that a certain amount of work is consumed in the formation by frictional resistance, and this work per unit of volume produced is proportional to the rate of production, and therefore inversely proportional to the time during which a certain volume is produced. The work consumed in the formation therefore approaches zero when the rate becomes infinitely small.

The potential level as a rule does not deviate much from the surface of the earth, so that the foregoing reasoning approximately applies to the surface of the earth. Therefore in case there is liquid without gas in the formation, the production can be accelerated by supplying extraneous energy for lifting, but an equal amount of work is then consumed by friction in the formation.

The above considerations and conclusions, except those concerning the proportionality of production per unit of time and thickness, also hold good if the strata overlying and underlying the sand are not entirely impervious.

As these strata are not quite impervious in most cases, the above deductions also apply if the sand under consideration has no outcrop[4].

If some oil (which for the moment may be assumed to be a single liquid with a low vapor pressure, containing no volatile substances) has accumulated in an anticline or dome (Figure 2), the conditions are not materially different. If a well is drilled into the oil, the foregoing applies to the oil. It will have the same pressure in grams per square centimeter as the water it replaces, but the level to which it rises above the layer is inversely proportional to the specific gravity. So the potential—if expressed in a column of oil—will be somewhat greater than the potential water would have at the same place. The oil will rise in a well to a certain level and the rate at which it can be produced is proportional to the diminution of pressure in the well. It should be kept in mind that the hypothetical case of oil containing no gas is considered.

The operator of a field is able to accelerate his rate of production by reducing the back-pressure on the face of the sand; i.e., by lifting the oil from a greater depth in his well. As in the case of water there is sufficient energy in the formation to produce the oil at the level to which it rises naturally in the well (practically to the surface of the earth), and if artificial energy is supplied for lifting it from a greater depth, the rate of production is increased, but a portion of the natural energy is then converted to heat in the formation through frictional resistance. This portion of the natural energy is equal to the artificial lifting work.

It has been inferred in the preceding pages that in a field with water-drive without any gas, the operator would have to supply practically all the energy to lift the oil, but as the energy required is proportional to the rate of production, the total energy he would have to supply would be small if the oil were produced at a slow rate.

Second Ideal Case—Production by Depletion

Assume a lens of sand confined by impervious shales, and that the pores of this lens are filled with gas-bearing oil. For the sake of simplicity the gas is assumed to be a single gas which is soluble in the oil and it is taken that all the gas is dissolved so that no free gas is present in the formation. The oil is again treated as a single liquid with a vapor pressure so low that it can be neglected. If the lens is lying flat the pressure can be assumed to be the same throughout.

The gas dissolved in the oil exerts a certain pressure. As long as the column of liquid in the well suffices to counter-balance the gas pressure nothing will happen. However, as soon as the pressure exerted by this column is diminished so that it is no longer able to counter-balance the gas pressure in the oil at the face of the sand, gas is liberated from the oil in the vicinity of the well. This entails an increase of volume so that part of the oil (which still carries some gas) and of the free gas would be forced into the well. So, if a certain pressure lower than that at which the oil is saturated with gas is maintained at the face of the sand, gas and liquid must flow from the sand towards the well until a new equilibrium has been established, independent of what happens within the well. With this final equilibrium the pressure maintained in the well at the face of the sand will prevail throughout the lens, and fluid no longer comes into the well.

The author has thus far used the term "depletion" for the partial displacement of oil by gas within the formation. Depletion as it is understood here is a very complex phenomenon. At the periphery of the lens the simplest kind of depletion takes place. Part of the oil and gas must leave the interstices at the periphery and move through the pores towards the well. Close to the well, however, not only simple depletion occurs, but also part of the oil and gas from outlying regions pass by. The consequence is that in the final condition a more complete exhaustion of the oil near the well is established than of the oil

at the periphery of the lens. It would appear to be impossible to make any calculations on this subject. It is probably not far wrong to assume that the process is practically isothermal, as will be explained later. The potential energy of the oil and gas within the formation decreases on account of the depletion, but an exact calculation as to the extent cannot be made.

Suppose there was originally a volume of oil $V_o \alpha$ in the formation at an absolute pressure p_o (in atmospheres). If the coefficient of absorption is α, then the oil originally contained a volume of gas $p_o \alpha V_o$ (at atmospheric pressure). If the pressure in the formation is p_1 after a volume of oil V_1 has been produced, the formation still contains a volume of free gas at a pressure p_1 or $p_1 V_1$ at atmospheric pressure and a volume of oil $V_o - V_1$, being saturated with gas at a pressure, containing a volume of gas $p_1 \alpha (V_o - V_1)$ at atmospheric pressure. produced with the oil.

So a volume of gas $p_o \alpha V_o - p_1 V_1 - p_1 \alpha (V_e - V_1)$ has been

The total work performed could be computed, provided V_o and V_1 were known. These, however, cannot be known until production has ceased, because it is impossible to hazard any theory on the way in which the energy from the expanding gas is imparted to the liquid, and how oil and gas move, so that the consumption of energy through friction is also beyond computation; further calculation is therefore of no value.

Therefore it is not possible to compute what volume of oil will be produced if pressure is at once lowered at the face of the sand to a certain value, and what time will be required. Nor can it be calculated how conditions will be altered if the pressure is lowered gradually.

If a lens as described above contained only oil, which may be assumed to be incompressible, then, whatever the pressure might be, there would be no energy to expel it from the formation, as the liquid would not expand so that the pressure could not do any work. However, if the surface of the liquid in the hole were kept at a lower level than the top of the lens, part of the oil might drain towards the well by gravity.

In the case of a lens filled with gas-bearing oil, as soon as the well is opened it fills with oil from which gas is being liberated, so that the gas can do work within the well, which results in lowering the pressure at the bottom of the well.

Two sources of energy have been treated thus far: (1) gravity acting on the liquid in the formation as a whole, and (2) energy accumulated in dissolved and free gas owing to pressure.

Gravity also acts on the gas and the liquids more directly. It causes the separation of these three fluids according to the specific gravity. Thus gravity tends to make the boundaries between the fluids horizontal. When the original condition of equilibrium is disturbed by a well, it means that the potential is altered, and then the boundaries may deviate from horizontal planes[8]. The differential specific gravity, however, tends to restore these horizontal contacts. This is all the more effective as the dip of the formation increases.

Within the depletion zones the oil tends to sink to the bottom of the layer, and also to flow down dip. Both these tendencies are caused by gravity.

Another source of energy is the intermolecular attraction, which partly counteracts production, but will not be treated profoundly herein. The minerals that constitute the strata are generally more easily wetted by water than by oil, while both liquids tend to wet a dry surface, thereby replacing gas.

When edge water encroaches, water replaces oil on the surface of the grains, the molecular energy then decreases, so that in this respect the molecular forces assist production, but to a very small extent. In the same way the molecular energy becomes smaller as oil invades the gas cap[8]. The author, however, realizes that the problem of edge water displacing oil on the surfaces of the grains of the sand is very intricate. The oil may have wetted the sand throughout geological periods and it is hard to tell how phenomena of absorption act in the long run. It seems questionable whether water is able to displace the oil on the surfaces of the sand grains at the same rate as it encroaches. So the question of how intermolecular energy interferes with production is, in the author's opinion, somewhat doubtful.

If the assumption is correct that the water in due time tends to displace the oil on the surfaces of the sand grains, the molecular forces promote drainage of oil from the formation; that is, if oil and water are both present within the sand, they will tend to shift so that the smaller pores become filled with water and the oil finds its way to the larger pores. While with edge-water encroachment motion is faster in the coarser pores, so that the border of the water would tend to advance most rapidly in the coarser parts of the sand, the action of molecular forces tends to promote the reverse, thus preventing much oil from being trapped.

When the formation is depleted, an interface between gas and oil arises. Energy is then consumed, and the tendency of the interface between oil and gas is to be as small as possible. This causes much oil to adhere to the grains of sand[8].

Thus far the two hypothetical cases that edge water or gas each interfere separately have been treated. In most cases, however, they act simultaneously.

As a common example of the occurrence of oil, the accumu-

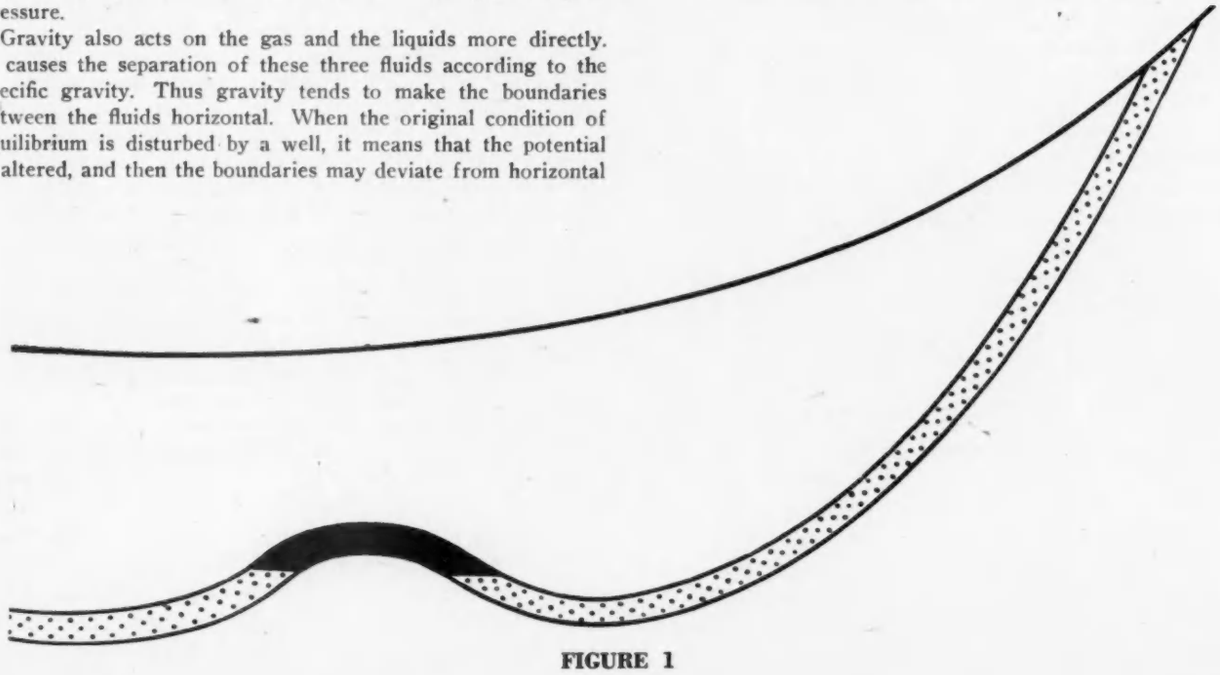


FIGURE 1

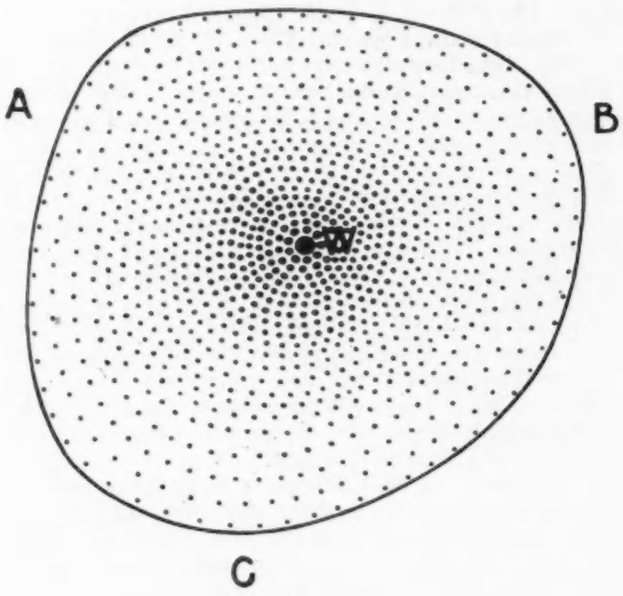


FIGURE 3

lation at the crest of a dome-shaped undulation in a persisting sand bed will be considered, in which the oil contains dissolved gas and is underlain by water, which exerts a pressure on it. It will be assumed that originally there is no gas cap in the structure.

If a well penetrates the sand within the oil zone, and pressure is maintained in this well at a value lower than the pressure of the oil, oil will flow into the well and it will be pushed up by the surrounding water, which may be called the edge water. The conditions of flow will then not differ materially from those treated as the first ideal case. However, as soon as the pressure within the well is decreased to a value lower than that at which the oil is saturated with gas, gas will be liberated, but at first only in the vicinity of the well. Consequently oil and gas will move into the well in the manner described for gas-bearing oil as encountered in a lens, but at the same time the boundary of oil and water will move towards the well. Movement within the well will again be left out of discussion. Within the zone around the well where pressure is decreased to such an extent that gas is liberated, a mixture of oil, containing dissolved gas and free gas, flows towards the well. At a greater distance, only liquid (oil plus dissolved gas) will flow through the sand as if there were no gas. The zone around the well where depletion has occurred will be called the depletion zone.

If the depletion zone (see Figure 3) at a time t has extended to the curve ABC, then within this curve a mixture of liquid and free gas flows towards the well, which cannot be analyzed with any degree of certainty. If it is now supposed that the pressure in the well is kept constant (although this is generally not the case), a dynamic equilibrium will finally be established, provided the pressure within the well is not kept at an excessively low value. Such an equilibrium requires that the volume of oil that enters the well W per unit of time (Figure 3) equals the volume of oil that passes the curve ABC and thus enters the depletion zone per unit of time.

When this equilibrium prevails, the potential of the liquid takes care of its transportation up to the curve ABC. Within this curve work is performed by the remainder of this potential and also by the energy of the gas. An attempt may be made to analyze the flow within the depletion zone after the establishment of dynamic equilibrium.

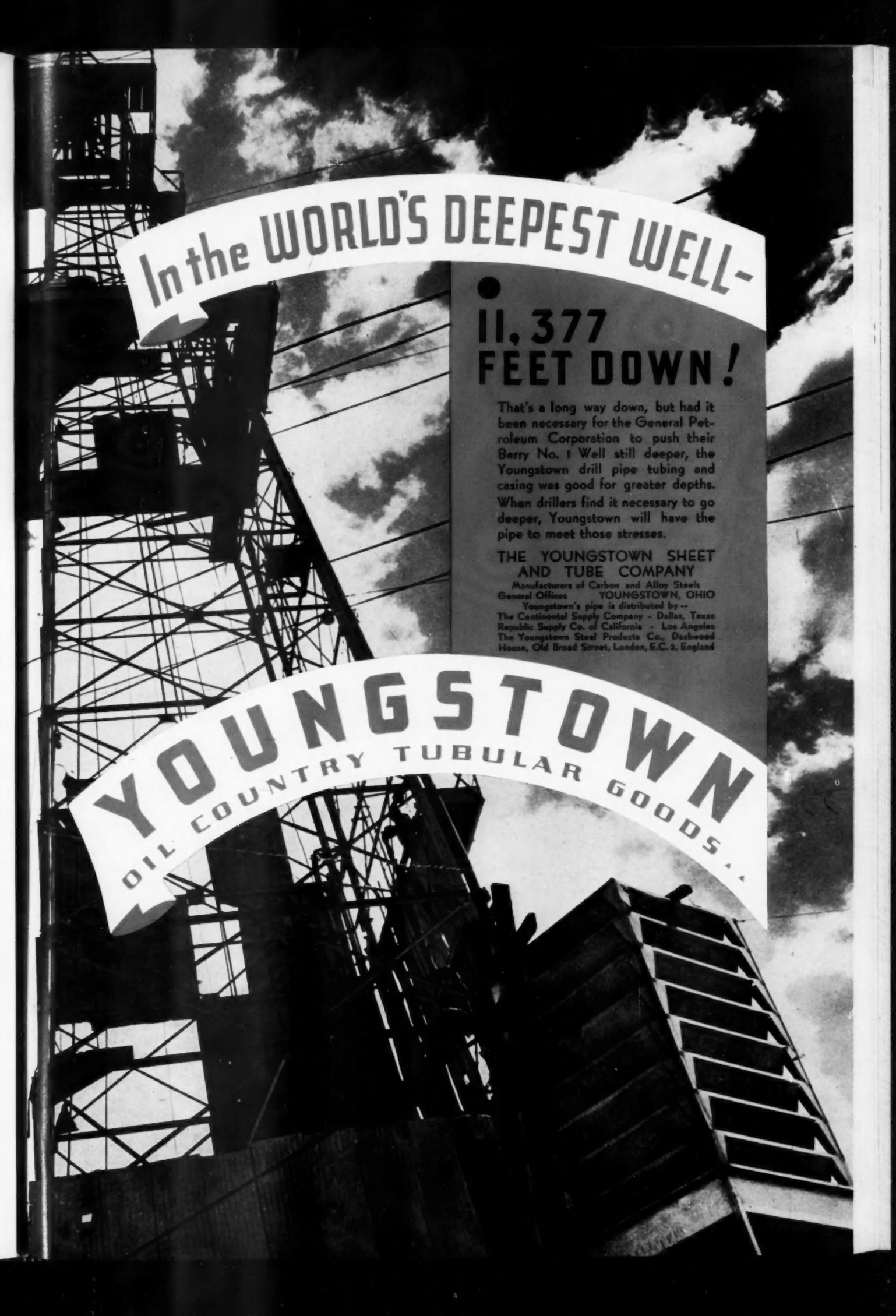
The following symbols will be used:

- p Pressure at an arbitrary distance from the axis of the well, in atmospheres.
- p_r Pressure at the bottom of the well.
- P Pressure at which oil would be saturated with the coexisting gas.
- P_1 Reservoir pressure.
- a Atmospheric pressure.
- q Volume of liquid flowing per unit of time through the unit of area in the cross-section.
- Q Volume of liquid flowing per unit of time through cross-section considered.
- v Volume of gas measured at atmospheric pressure per unit of time flowing through unit of area in cross-section.
- u Same measured at prevailing pressure.
- R Depletion radius.
- K Darcy's coefficient; this is the volume of a liquid of unit coefficient of viscosity, flowing per unit of time through the unit of area of the cross-section, when drop of pressure head is equal to unit of force per unit of area, per unit of length.
- η_o Coefficient of viscosity of oil.
- η_g Same for gas.
- α Absorption coefficient of gas and oil.
- ρ Horizontal distance from the point under consideration to axis of well.
- Σ Thickness of oil-bearing layer.

W_1, W_2 etc. Amounts of work.

The ideal condition of the flow of oil and gas to a well is the following: The thickness of the oil-bearing layer is unvaried over a great area, the layer lies nearly horizontally and the well is perforated or open opposite the whole thickness of the sand. The sand slopes at a small rate in all directions from the well for a great distance and the line of the edge water is at a great distance from the well. The oil contains dissolved gas but the initial pressure is greater than the pressure at which the oil would be saturated; so there is no free gas before the well is opened. Under these conditions, the motion of oil and gas may be assumed to be horizontal and so slow that kinetic energy may be neglected. Thus all positive work performed is counter-balanced by the work of the internal friction of liquid and gas, and the former in this way is converted to heat. When gas is liberated from the oil a certain amount of heat is expended so that cooling will be the result. Cooling will also be caused by the subsequent expansion of the gas. Oil and Gas flow through the pores of the sand and energy is consumed thereby, which is converted to heat; this energy is supplied by the liberation and the expansion of the gas. Part of the cooling effect is counter-balanced by the heat produced by friction. Moreover, there is an excess of oil which together with the rock has a considerable heat capacity, so that the cooling, even if the gas does not quite follow Boyle's law, is probably not very important. The unimportant changes of temperature will be disregarded, for sake of simplicity, in the mathematical development.

As the well is opened, the pressure therein is decreased and oil and gas flow towards the well; at the same time edge water moves towards the well. The pressure in the well, however, is so decreased that within a certain radius R, a part of the dissolved gas is set free. Consequently, within this radius R oil and the dissolved gas, but also free gas, flow to the well; outside this radius oil with only dissolved gas flows toward the well. Thus the curve ABC in Figure 3 becomes a circle with a radius R, and within this radius depletion takes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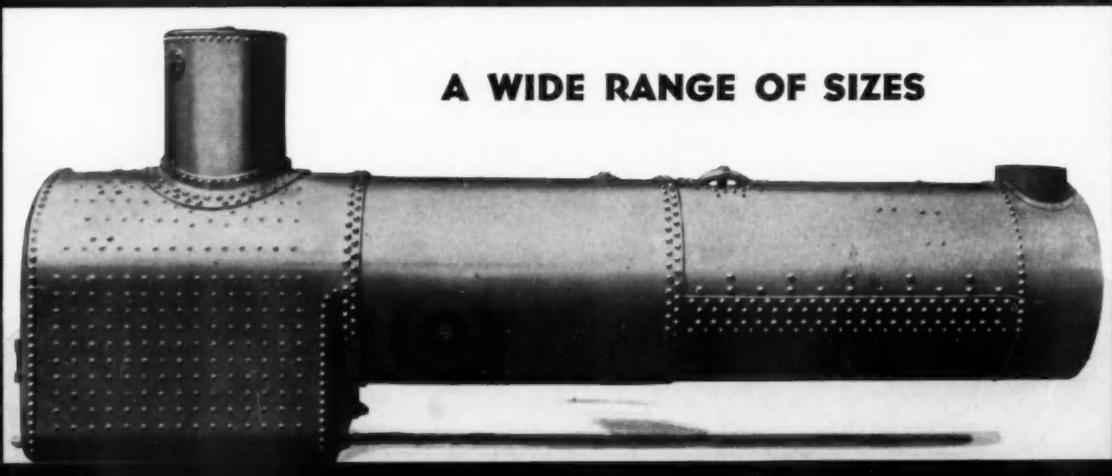
A WIDE RANGE OF SIZES



place, which means that a portion of the pores of the sand no longer are filled with oil but with gas. This radius will be called the "depletion radius." The sand, as it has been stated before, is supposed to be not very thick and it will be presumed that the paths of the gas and the oil molecules are horizontal, so that gravity exerts no work by its action on these molecules.

As has been stated before, within the depletion radius oil is partly displaced by gas and this oil flows to the well. This is a part of the production of the well. Consequently, the production of the well should be variable with time. If this were taken into account, the problem would be too complicated, and at first it will be supposed that a dynamic equilibrium has been established. Afterwards an attempt can be made to take the influence of time into account by means of an approximation. A condition of dynamic equilibrium being considered, it is assumed that the condition is independent of time, which means that constant volumes of oil and gas flow to the well per unit of time. The velocities of oil and gas in the sand vary with respect to the distance to the well. According to the assumption that the depletion radius no longer increases, pressure does not vary with time and the depletion radius R is invariable. Under these circumstances, the pressure at a distance R from the axis of the well is so great that oil at that distance is saturated with the coexistent gas. Thus, within the depletion zone a mixture of oil and gas flows to the well while at a distance greater than this radius merely liquid with dissolved gas, which behaves as an ordinary liquid, flows to the well. Through every cylindrical surface generated by the evolution of a vertical line about the axis of the well, the same volume of oil flows to the well per unit of time and also the same amount of gas. Within the distance of the depletion radius, two conditions may occur: (1) oil and gas flow at the same speed at any distance from the well, and (2) free gas and oil have different velocities at any distance from the well.

As the oil approaches the well, pressure decreases and more gas is set free, and at the same time gas that has already been liberated expands. So work is performed not only by the difference of pressures in the well and at a distance R from the well, but at the same time work is performed by the gas at the moment it is set free and by its expansion[7]. Owing to the motion of oil and gas through the pores, internal friction causes resistance and this resistance performs negative work. The velocities of oil and gas, as has been explained before, are so small that they may be neglected and practically no potential energy is converted into kinetic energy.

Equations of the equilibrium will be deduced for the various quantities of work performed per unit of time in the space that is enclosed by the cylindrical surfaces with radii ρ and $\rho + \partial\rho$ about the axis of the well. It will first be assumed that the first of the above-mentioned conditions prevails; viz., oil and gas flow at the same speed.

Flow of an uncompressible liquid like oil is determined by Darcy's[2,3] law, which can be written as follows:

$$q = \frac{Ka}{\eta_o} \frac{\partial p}{\partial x} \tag{4}$$

if x is the distance measured in a direction opposite to the motion.

As it has been explained in a former paper,[8] for a gas this equation can be written as follows:

$$u = \frac{Ka}{\eta g} \frac{\partial p}{\partial x} \tag{5}$$

as it has been presumed that Boyle's law applies to the gas. If in this equation $\frac{V}{p}$ is substituted for u, this equation is converted to:

$$v = \frac{Ka}{\eta g} p \frac{\partial p}{\partial x} \tag{6}$$

Outside the radius R, according to Henry's law, which is assumed to hold good, the amount of gas dissolved in the unit of volume of oil would occupy a volume:

$$\propto P \tag{7}$$

at atmospheric pressure. Within this radius pressure is $p < P$, at a distance ρ from the axis of the well and consequently at that distance a quantity of gas which occupies a volume:

$$\propto p \tag{8}$$

at atmospheric pressure would be dissolved per unit of volume of oil. The gas that is set free per unit of volume of oil would occupy a volume:

$$\propto (P - p) \tag{9}$$

at atmospheric pressure and:

$$\propto \frac{P - p}{p} \tag{10}$$

at the prevailing pressure.

As long as the dynamic equilibrium exists, a constant volume of oil Q flows per unit of time through every cylinder and this volume of oil is accompanied by a volume of gas which, according to equation 10, would occupy a volume:

$$Q \propto \frac{P - p}{p} \tag{11}$$

at the prevailing pressure. It has been assumed that gas and oil have formed an intimate mixture. The pressure on the cylinder with radius ρ pushes a volume of oil Q and a volume of gas as expressed by formula 11 per unit of time through this cylinder. The work performed by the pressure on the oil is:

$$a\, Q\, p \tag{12}$$

and the work performed by the pressure on the gas is in the same way:

$$a\, Q \propto (P - p) \tag{13}$$

The differential of the two amounts of work performed by the pressure on the portion of the sand between the two cylinders with radii ρ and $\rho + d\rho$ is the sum of the differentials of equations 12 and 13, so for this work may be written:

$$d\, W_1 = a\, Q\, (1 - \propto) dp \tag{14}$$

Within the space between the two cylinders that is being considered, part of the gas is dissolved and part of the gas is free. As they enter this space, gas and liquid have a pressure $p + dp$ and as they leave this space the pressure is p. In a former paper,[7] it has been proved that the amount of work performed does not change if a part of the gas is dissolved in liquid and saturates it. This has been deduced as follows: If the considered liquid is saturated at a pressure $p + dp$ with an amount of gas which at atmospheric pressure occupies volume V_1, and if the amount of gas that is free would occupy the atmospheric pressure volume V_2, the increment of volume of the free gas is $\frac{V_2}{p} - \frac{V_2}{p + dp} = V_2 \frac{dp}{p}$ as pressure decreases to $\frac{V_2}{p} dp$. At a pressure p the volume of this amount of gas would have been $\frac{V_2}{p} dp$. The volume of the dissolved gas, which would have been V_1, at a pressure $p + dp$, would have been reduced to a volume $V_1 \frac{p}{p + dp}$ as a pressure would have

decreased to p, both volumes measured at atmospheric pressure. So as the pressure decreases from $p+dp$ to p an amount of gas is set free, the volume of which would be $V_1 - V_1 \frac{p}{p+dp} = V_1 \frac{dp}{p}$, and at the prevailing pressure the volume would be $\frac{V_1}{p^2} dp$. As a consequence of the decrease of pressure, the volume of liquid and the coexistent gas has increased $(V_1 + V_2) \frac{dp}{p^2}$. The work performed at this increment of volume is $(V_1 + V_2) \frac{dp}{p}$. So the work performed is independent of the presence of liquid in which a part of the gas is dissolved at the prevailing pressures, as the sum $V_1 + V_2$ is not changed by the presence of the liquid. So the work performed at the liberation and the expansion of gas within the space under consideration is:

$$d W_2 = a \propto P Q p \left(\frac{1}{p - dp} - \frac{1}{p} \right) = a \propto P Q \frac{dp}{p} \qquad (15)$$

The work that is performed per unit of time by the friction resistance in the space under consideration which is a ring, can be expressed as follows: The total volume that flows per unit of time through the inner cylinder is the sum of the volumes of oil and gas expressed by equation 11:

$$Q + Q d \frac{P - p}{p} = Q \frac{p + \propto P - dp}{p} \qquad (16)$$

Per unit of area, this volume is:

$$\frac{Q}{2\pi\rho\Sigma} \frac{p + \propto P - dp}{p} \qquad (17)$$

In case q units of volume of oil would flow through the unit of area in the cross-section and no gas, the resistance in this space would be:

$$- \frac{q \eta x_o}{K} d\rho \qquad (18)$$

and the total force exerted by this resistance would be:

$$- 2\pi\rho\Sigma \frac{q \eta x_o}{K} d\rho \qquad (19)$$

This force would develop an energy per unit of time:

$$- 2\pi\rho\Sigma \frac{q^2 \eta_o}{K} d\rho \qquad (20)$$

If instead of q the value of formula 17 is substituted, formula 20 is converted to:

$$- \frac{Q^2}{2\pi q \Sigma} \frac{\eta_g}{K} \left\{ \frac{p + \propto P - \propto p}{p} \right\}^2 d\rho \qquad (21)$$

In the same way for the work of resistance in the gas the following equation can be deduced:

$$- \frac{Q^2}{2\pi\rho\Sigma} \frac{\eta_g}{K} \left\{ \frac{p + \propto P - \propto p}{p} \right\}^2 d\rho \qquad (22)$$

The volume in which the pores are filled with oil in the annular solid is expressed by:

$$2\pi \rho d \rho \frac{p}{p + \propto P - \propto p} \qquad (23)$$

and the volume in which the pores are filled with gas is:

$$2\pi \rho d \rho \frac{\propto (P - p)}{p + \propto P - \propto p} . \qquad (24)$$

So the total work performed per unit of time by friction resistance in the annular solid is:

$$d W_3 = - \frac{Q^2}{2\pi K \Sigma} \frac{(p + \propto P - \propto P)(\eta_o p - \eta_g \propto P)}{p^2} \frac{d\rho}{\rho} \qquad (25)$$

The algeraic sum of the various amounts of work must be O, hence one may write:

$$dW_1 + dW_2 + dW_3 = O \qquad (26)$$

or:

$$a Q (1 - \propto) dp + a \propto P Q \frac{dp}{p} \qquad (27)$$

$$- \frac{Q^2}{2\pi \Sigma K} \frac{(p + \propto P - \propto p)(\eta_o p + \eta_g \propto P - \eta_g \propto p)}{p^2} \frac{d\rho}{\rho} = \frac{d\rho}{\rho}$$

The variables can be separated as follows:

$$\frac{Q}{2\pi \Sigma K a} \frac{d\rho}{\rho} = \frac{p \, d \, p}{\eta_o p - \eta_g \propto p + \eta_g \propto P} \qquad (28)$$

The second of the above-mentioned conditions, oil and gas flow at different velocities, will also be considered. In order to solve this problem, two equations of equilibrium will be deduced, one for the work performed in the oil and one for the work performed in the gas. It will be presumed that in the cylindrical surface about the axis of the well with the radius ρ, which has an area $2\pi\Sigma\rho$ within the sand in a portion of $2\pi\Sigma\rho$, the pores are filled with oil and in a portion $2\pi\rho(\Sigma - y)$ with gas. For a dynamic equilibrium it is necessary that at the same distance ρ pressure in oil and gas are the same. The pressure differential caused by the height of the column of liquid will be neglected as has been done before.

The work performed by pressure is:

$$d W_1 - a Q dp \qquad (29)$$

and the work of the resistance:

$$d W_3 = - \frac{Q \eta_o}{2\pi \rho y K} d\rho \qquad (30)$$

The equilibrium is expressed by:

$$dW_1 + d W_3 = O \qquad (31)$$

or:

$$a Q dp - \frac{Q^2 \eta_o}{2\pi \rho y K} = O \qquad (32)$$

This equation can be transformed as follows:

$$2\pi K a y dp = Q \eta_o \frac{d\rho}{\rho} \qquad (33)$$

This is the equation of the equilibrium of the work per unit of time performed in the oil. For the gas the following deduction can be made: The work of pressure is:

$$d W_1 = - a \propto Q dp \qquad (34)$$

The work performed by the gas at its liberation and its expansion is again expressed by equation 15. The work of the resistance is expressed by equation 31, if $\Sigma - y$ is substituted for y, η_g for η_o and if Q is replaced by the volume of the free gas at the pressure p. This gas volume is expressed by equation 10. So one may write:

$$d W_3 = - \left(\frac{P - p}{p} \right)^2 Q^2 \frac{\eta_g \propto^2}{2\pi \rho (\Sigma - y) K} d\rho \qquad (35)$$

An equation of equilibrium can be deduced from the equations 35, 15 and 36:

$$d W_1 + d W_2 + d W_3 = O \qquad (36)$$

or

$$-\underline{a} \propto \underline{Q}\ \underline{dp} + a \propto \underline{P}\,\underline{Q}\ \frac{\underline{dp}}{\underline{p}} - \left(\frac{\underline{P}-\underline{p}}{\underline{p}}\right)^2 \frac{\underline{Q}^2 \eta_g \propto^2}{2\pi \underline{K}\,(\Sigma - \underline{y})}\ \frac{\underline{d\rho}}{\rho} = O$$

or (37)

$$2\pi\ \underline{K}\ \underline{a}\ (\Sigma - \underline{y})\ \underline{dp} = \underline{Q}\ \eta_g \propto \frac{\underline{P}-\underline{p}}{\underline{p}}\ \frac{\underline{d\rho}}{\rho} \qquad (38)$$

This is the equation of the equilibrium of gas which combined with the equation 33 for oil will yield the solution of the problem. The equations 33 and 38 are two simultaneous differential equations in which the three variables ρ, p and y enter and the differentials of ρ and p. From these two differential equations y may be eliminated and again equation 28 is obtained.

Integration of this equation between two arbitrary limits of each variable, respectively ρ and ρ_1, p and p_1, gives the following solution:

(39)

$$\frac{2\pi\ \underline{K}\ \underline{a}\ \Sigma}{(\eta_o - \eta_g \propto)}\ 2\ \underline{Q}\left[(\eta_o - \eta_g \propto)\ (\underline{p}-\underline{p}) - \eta_g \propto \underline{P}l_g\ \frac{(\eta_o - \eta_g \propto)\ p + \eta_g \propto P = l_g\ \rho}{(\eta_o - \eta_g \propto)\ p_1 + \eta_g \propto P}\ \frac{}{\rho}\right.$$

If, however, equation 28 is integrated between the limits r and R, respectively, p_r and P, the following equation is obtained:*

$$\underline{Q} = \frac{2\pi\ \Sigma\ Ka}{l_g\ R - l_g\ r} \times \frac{1}{(\eta_o - \eta_g \propto)} 2\left\{\eta_o - \eta_g \propto)\ (P - pr) - \eta_g\ Pl_g \frac{\eta_o P}{(\eta_o - \eta_g \propto) p_r + \eta_g \propto P}\right\} \qquad (40)$$

If $\propto = O$ is substituted in formulas 28, 39 and 40, which means that gas is insoluble, the following equation is obtained:

$$\frac{\underline{Q}}{2\pi\ \Sigma\ \underline{K}\ \underline{a}}\ \frac{\underline{d\rho}}{\rho} = \eta_o\ \underline{dp} \qquad (41)$$

$$\underline{Q} = \frac{2\pi \underline{K}\ \underline{a}\ \Sigma}{\eta_o}\ \frac{p - p_1}{l_g \rho - l_g \rho_1} \qquad (42)$$

and

$$\underline{Q} = \frac{2\pi \underline{K}\ \underline{a}\ \Sigma}{\eta_o}\ \frac{P - p_r}{l_g R - l_g r} \qquad (43)$$

Supposing that gas is insoluble means that no gas is present, and the pores are wholly filled with oil. There would not be a material depletion. Formula 43 is practically J. Dupuit's formula 9 for the flow of water to an artesian well.

It has been presumed in the foregoing deductions that η_o is independent of the pressure. This is not exact, but thus far no mathematical expression concerning the variation of the viscosity of oil with the amount of gas dissolved is known.

Another point has been neglected in the above formulas. The volume of the liquid also depends on the amount of gas dissolved in the oil. For the moment no data in regard to this question are available; at least they are not expressed in a general formula. Furthermore, it has been accepted that a dynamic equilibrium has been established.

*A formula for the flow of gas without oil towards a well was derived by the author (see Reference 8, page 1101), and independently Muskat and Botset found the same formula (Ref. 13 and Ref. 10, formula 4a, p. 181).

Some assumptions were made and on the basis thereof it seemed that, although the amount of energy supplied by the gas was considerable, it had a relatively small effect on the rate of flow. From the derived formulas 40 and 43, it would follow that after the establishment of equilibrium the rate of production is smaller than it would have been with the same pressure at the face of the sand if no gas were present, the expression on the right of the equation being greater in equation 43 than in equation 40. This negative effect of the work produced by the gas in excess of the work done by the potential of the liquid is due to the fact that the speed of the motion within the depletion zone is great, as not only liquid, but liquid mixed with a great volume of free gas flows therein, so that the work consumed by frictional resistance is great. Thus one could say that the gas on being liberated and expanding performs a useful work, but at the same time its presence forces the oil to move at a greater velocity for the same rate of production, so that the work that is required for sustaining this motion at the same time is increased considerably.

Therefore, as soon as the equilibrium is established, the part played by the free gas does not materially increase the rate of flow through the sand. This reasoning would lead to the conclusion that the role of gas in production is not very important in the case of a water-drive field. However, one should not lose sight of the fact that the importance of gas for lifting liquid in the well has been left out of consideration. The importance of gas as a means of simplifying the method of lifting the oil from the bottom of the well to the surface remains unchallenged, as the gas enables the operator to maintain a low pressure at the face of the sand.

So far, consideration has been given only to the flow after dynamic equilibrium has been established. Prior to the establishment of dynamic equilibrium the depletion zone is forming, which means that the gas displaces oil and thus greatly accelerated production. The oil is entering the well at a rate greater than that at which it passes the boundary of the depletion zone, which is constantly increasing its area. This means that in the vicinity of the well oil is being displaced by gas in the pores of the sand as long as the depletion zone is forming. More oil-saturated sand is giving off part of its oil, and the sand that has already been partly depleted is yielding a still greater portion of its oil. This process, which determines the flush period of the wells, continues until dynamic equilibrium is established. This equilibrium is the stage where the amount of oil produced by the well is counterbalanced by the oil propelled by the potential of the liquid; that is to say, the amount that is pushed up by the pressure of the edge water.

If the edge water does not move up (which means that outside the oil there is such a resistance in the formation that even with a negligible rate of flow the work consumed by frictional resistance is great), an equilibrium as described above will never be attained. That is to say, the gas is the only source of energy that propels the oil to the well, and the case of the lens prevails.

(in previous papers [5], [6] the author ventured the theory that absence of edge-water encroachment may be partly inherent in the principles that cause accumulation of oil and partly in differential compaction after accumulation of oil and gas. Compaction of the sandy strata was supposed to be established through dissolution and redeposition, which is only possible in water-filled sands, and not in portions of the sand where the pores are filled with oil or gas. At the World Petroleum Congress in London (July, 1933) the author mentioned another possibility; viz., that the clayey substances in

the pores might have a small volume within the oil but swell as soon as they come into contact with the edge water. If this is true, the clayey particles tend to clog the pores as soon as they are wetted with water. R. P. Lockwood believes that sulfates in the water may act upon the oil at the periphery inasmuch as they make it more asphaltic. This idea may be correct, but the author wishes to state that it is applicable only if the connate water of the formations has been displaced by water charged with sulfates. One may assume that before accumulation of the oil it was distributed throughout the clayey layers or shales and every minute globule of oil would have become asphaltic before accumulation. Only if sulfate-charged water has penetrated the formation after the accumulation of oil can the inspissation of the oil be limited to the borders.)

When the edge water actually pushes up the oil, the boundary of the edge water and the oil will approach the well. When, however, oil is displaced by water in a part of the sand, the internal friction of water, instead of that of oil, must be considered, so that the total work of resistance is altered. The result is that, if the pressure at the bottom of the well is maintained at a certain constant value, theoretically no dynamic equilibrium will be established. Practically such an equilibrium, however, arises.

In the above example it has been assumed that no gas cap exists. If there is a gas cap, then, owing to the drop of potential caused by the opening of a well, the gas cap expands. The effect of this expansion is that oil is pushed towards the well in the same way as it was by the potential of the edge water. As a consequence, with the same drop of pressure in the well, the production of the well will be greater owing to the combined influences of gas cap and edge water. The expansion of the gas cap will slightly modify the flow condition of the edge water. When there is a gas cap, the production is stopped before the gas from the gas cap has reached the well, the gas cap will be recompressed owing to the potential of the edge water. This means that the gas cap is a source of energy which temporarily aids in propelling oil to the well. However, this source of energy differs greatly from the potential energy of the edge water, inasmuch as it expands only to a certain extent, depending on the drop of pressure caused in the formation. Moreover, the energy of the gas cap is gradually restored by the potential energy of the edge water after production has been stopped.

The motion due to the potential of the edge water, combined with that caused by the expansion of the gas cap, takes place throughout the formation, whereas the motion due to depletion is limited to a zone round the well. Therefore the former may be called "general motion," and one can distinguish "production by general motion" from "production by depletion."

As soon as the edge water reached the depletion zone, conditions changed materially, since the gases that are dissolved in the oil are not so well absorbed by water. Although depletion is also possible in water, for the sake of simplicity it will be assumed that no gas is absorbed by it. As soon as the border of the edge water has passed the boundary of the depletion zone, an entirely new condition will arise. The water that now enters the depletion zone does not yield any gas, and it has not only to replace the oil but also to recharge with liquid the pore space that was occupied by gas. Therefore, from the moment the edge water reaches the boundary of the depletion zone, the task of the potential of the liquid in the formation is no longer to supply the depletion zone with a volume of liquid per unit of time equal to the production of the well, but at the same time to recharge the depletion zone with liquid. Frictional resistance of water is smaller than that of most oils, so that, as the edge water approaches the well with the same pressure at the bottom of the well, its liquid production would increase in most cases, but when water invades the depletion zone, the process of recharging the zone will more than counterbalance the other effect, and the result will be that the liquid production of the well will decrease until the water reaches the well.

Moreover, one has to deal with the problem of how long it takes the edge water to displace the oil on the surface of the grains. The time this process takes determines also the time in which water will wash out all the pendular oil [6, 7] and penetrate the narrowest pores. Insufficient data concerning this question are as yet available.

The main value of gas in oil production is, in general, its capacity to lift the oil to the surface, although in water-drive fields it is also of importance, as it accelerates the production in the first stages. In fields without water drive it propels the oil to the wells, but it is never capable of producing all the oil from the formation. In such fields the direct action of gravity on the oil must complete the drainage of the field, unless this is done by artificial flooding.

In fields with actual water drive the role of gas, next in importance to lifting the oil, is to accelerate the production at the beginning of the exploitation period. In the later life of the field, when edge water reaches the depleted area, there is a tendency for the rate of production to decrease as the depleted zone has to be recharged with liquid. The time gained during the earliest stage of the life of the field on account of the flush is lost in the final stage. However, the fact should not be lost sight of that because of the flush period the investment is soon recovered and the losses on account of rentals are decreased.

In a previous paper [12] the author argued that gas from a gas cap should be conserved as much as possible for reasons stated in that paper. In the same way that edge water may "cone up," gas caps may "cone down," increasing the gas-oil ratio of the wells. This should be avoided, in the author's opinion, by beaning down the wells. There is no reason, however, to assume that beaning down the wells will have any favorable influence on the ultimate recovery of a fluid as long as "coning down" of the gas cap, which manifests itself by a gas-oil ratio that is several times greater than the gas-oil ratio during the flush production, does not interfere with the production.

Although the role of gas in oil production is very important, for the various reasons set forth in the foregoing paper, the importance of gas is sometimes overestimated.

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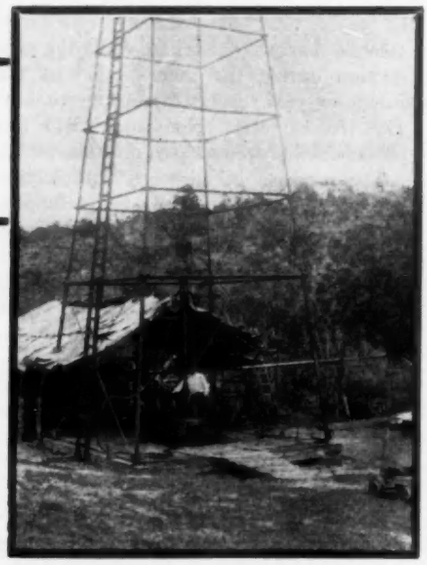
FOREIGN DEVELOPMENTS AND TECHNOLOGY



Increase in German Oil Production Through Governments Program

***Dipl-Ing.* KURT A. SCHUTTE**

GREAT importance is attached at present to making Germany self supporting as far as oil needs are concerned. The yearly oil consumption in so highly a motorized country as Germany is very large, with the result that it is obliged to import the greater part of its needs because domestic sources are limited and to a great extent undeveloped.

Annual production for the past years has increased from 232,000 tons to 300,000 tons; but this production is still very irregular, and it is therefore not possible to foresee the future of Germany's oil fields.

Present efforts are concentrated on making new discoveries. Of particular interest in this connection is the government drilling program.

The plan for 1934 includes 57 new wells. This is the first step towards tapping German oil reserves by the government. One half of the cost of the wells is borne by the government in the form of loans. Independent drilling without government aid is rather small.

According to the 1934 program 46 wells were to be drilled in Hanover, eight in Thuringen, two in Baden and one in Westfalen. Thirty-one of the 43 wells in Hanover were to be deep wells up to 2000 meters and 15 shallow wells up to 650 meters.

According to Dr. A. Bentz at the meeting of the Deep Drilling Association in Goslar, 14 salt domes and five other geological structures were to be drilled in Hanover. With the other wells drilling in Thuringen, Baden and Westfalen, 28 new geophysical structures would be explored.

The new wells were to be distributed according to government drilling program over an area extending from the Dutch border in the west to the Harzvorland in the south through Gifhorn in the east and Sottorf (Harburg) in the north.

In the Province of Hanover, new wells are drilling on the following salt domes: Sohlingen, Sottorf, Steinhuder Meer, Suelze, Rietze, Wienhausen, Moelme, Brechtsbuettel, Holzbalge, Bordfeld-Sophiental, Hillersee, Gifhorn, Ronnenberg and Kallmoor.

As only two wells are being drilled on each salt dome, a clear structural conception of the 14 salt domes naturally will not be possible. Yet, checks of formations to date are not available as most of the wells are in process of drilling, but interesting oil shows were found in a few places.

In connection with this first step of the government drilling program an important government geophysical work is also under way. The government has appropriated one hundred million marks for this work.

From past experiences it is hoped that these explorations will result in a larger number of oil producing salt domes.

Production Record

German crude oil production, since the beginning of 1933, has been steadily increasing. The efforts to cover the requirements of petroleum products for the motor-driven means of transportation in an ever-increasing degree by production secured within Germany's own borders, has led, in recent months, to the attaining of peak productions, as is shown by the production records.

If Germany's crude oil production during 1928 is represented by 100 units, we find that, according to the latest reports, the production during July amounted to 406.0 units. In the beginning of 1934 this same index number was 293.0. Therefore, Germany's crude oil production during the first half of 1934 was about 25 percent higher than it was in the spring of that year.

The following tabulation shows the development of Germany's crude oil output during the first seven months of 1934:

Period	Index Number
1928	100
January, 1934	293.0
February	265.5
March	306.9
April	341.3
May	321.2
June	348.2
July	406.0

Prussia's Output, First Half, 1934

According to the preliminary reports of the official Prussian Press Service, it is found that Prussia's monthly crude oil production reached the following amounts:

	FIELDS*							
	Hanigsen-Nienhagen		Wietze-Steinfoerde		Edesse-Oberg-Oelheim		Prussia's Total Production	
Months	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels	Metric Tons	Barrels
January	14,256	106,207	4,386	32,676	2,114	15,749	20,756	154,632
February	12,882	95,971	4,112	30,634	1,805	13,447	18,799	140,053
March	15,249	113,605	4,475	33,339	2,004	14,930	21,728	161,874
April	18,141	135,150	4,270	31,812	1,742	12,978	24,153	179,940
May	16,702	124,430	4,362	32,497	1,665	12,404	22,729	169,331
June	18,708	139,375	4,343	32,355	1,589	11,838	24,640	183,568
July	22,640	168,668	4,438	33,063	1,504	11,205	28,735	214,076
Total	118,578	883,406	30,386	226,376	12,423	92,551	161.540	1,203,474

*Note by translator: For general purposes the conversion of metric tons into barrels is based on the assumption that this oil is of 36° A.P.I. gravity, so that the figures in barrels are estimates.

The above figures show that, after an initial decrease in output, caused by difficulties of production, the yield in the province of Hannover increased steadily. In July the production for this field amounted to 28,735 metric tons (214,076 barrels), this being the maximum monthly production which had ever been obtained here up to this time. In the first half year of 1934, the production amount-

ed to a total of 132,805 metric tons (989,397 barrels) of crude, while the production during the same period of the foregoing year reached 106,600 metric tons (794,170 barrels). Nienhagen field has produced the greater part of this oil.

The increase in Germany's production is mostly due to Nienhagen field. Happily, conditions in this field have considerably improved lately. Several wells were drilled here which had daily productions of 100 metric tons (745 barrels) and more. These successful tests are located in the north part of the field.

The well named Krug von Nidda has become very well known on account of the fact that its initial production amounted to more than 200 metric tons (1490 barrels) per day. The Itag Company started to drill this test with rotary tools on December 19, 1933. The producing formation, the Wealden sandstone (this is the basal formation of the Lower Cretaceous) was penetrated on February 24 at a depth of more than 1000 meters (3281 feet). This test is situated farthest south and nearest to the center of the saddle. This means that a considerable amount of risk was connected with the drilling of this well. A point of especial importance is the fact that the Krug von Nidda 10 was the first test in the north field of the Nienhagen salt dome to find production in the Wealden.

Also productive in this field is a recently completed well called Gargoyle VI, which was also drilled by Itag Company. This well had an initial production of almost 100 metric tons (745 barrels). At present it pumps approximately 60 metric tons (447 barrels) per day. This production, likewise, is obtained from the Wealden sandstone.

Well N-22 also found production. Its daily output amounts to 60-70 metric tons (447-522 barrels) and the oil originates in both the Wealden and Valdensis (next higher zone in the Lower Cretaceous) formations.

The fact that several wells started to produce from the Wealden sandstone resulted in a decline of Krug von Nidda 10's output. This latter well is being produced by gas lift and yields at present 40-50 metric tons (298-373 barrels) per day.

Another test which was completed a few days ago is Aufbau 1. It was drilled by the German Vacuum Oil Company and came in with a daily production of 40 metric tons (298 barrels). This well has a depth of more than 1200 meters (3937 feet) and is located in the north part of the Nienhagen field.

In the meantime, well Aufbau 2 has reached a depth of 900 meters (2953 feet), the same as test N-24. Well N-25 has just been started.

Test E-63 has reached the Wealden formation. E-66 has penetrated the oil sand. E-62, after having found some small production in the Valdensis, was deepened to the Wealden which, however, produced only salt water. Two other tests are being drilled by the Elwerath Company. They are located near E-62 and E-60.

New tests which are under way are Krug von Nidda 11, Froehlich 3 and 4 and G-3.

Well N-20 tested the Wealden formation and found it to be water-bearing, after which the well was plugged back to the Valdensis zone from which it is now producing.

Operations on N-18 were stopped as this test found only salt water in both the Wealden and Valdensis formations.

E-18 and Dea-6 also found strong flows of salt water and had to be shut down.

E-44 is sanded up and produces only small amounts of oil at present. Originally this well came in with a daily production of 100 metric tons (745 barrels).

Baden is one of the southwestern German states. The River Rhine constitutes its western boundary line. The government has given a concession for the production of bitumen in the gaseous, liquid and solid state to a mining company called "Forst-Ubstadt," founded September, 1934. The fields included in this concession have an area of approximately 38 square kilometers (9,390 acres).

It is hoped that conditions here will be similar to those found in the French Pechelbronn (Alsace) oil field. This is the reason that, in conformance with the national drilling program for the year 1934, exploratory wells will be drilled in these Baden fields. The national government will subsidize these operations.

Some years ago, tests were drilled in this Forster area. They found oil at shallow depths, but not in paying quantities. These new tests, therefore, are intended to explore the deeper formations. It is the opinion in technical circles that it cannot be expected that the occurrence of oil in paying amounts will be established in the near future. The investigations, made so far have shown that geological conditions in the valley of the Rhine are extraordinarily complex.

Houston Geological Society New Officers

Houston.—At the recent meeting of the Houston Geological Society officers for the ensuing year were elected. Wayne Bowman, Tide Water Oil Company, President; John Miller, The Texas Company, Vice President; Phil Martin, Houston Oil Company, Secretary and Treasurer. The retiring officers were Dr. M. R. Hanna, Gulf Production Company, President; Wayne Bowman, Vice President and John Miller, Secretary and Treasurer.

East Texas Violators Fined by Visiting Judge

(*Continued from page 7*)

granted a temporary injunction March 21. The court order was set aside a few days later, and the law was upheld in higher courts.

Judge Dibrell fined Canico Oil Company $750 for producing a well in the G. F. Penn Survey, Gregg County, 162 barrels above its allowable during a three-day period in the latter part of June. The company was not represented at the hearing.

S. B. Pope, identified as the owner and operator of Keystone Refining Company, which has a plant near Gladewater, was fined $6500 on October 11 for handling untendered crude oil over a period of 10 days in May. Judge Dibrell assessed punishment at rate of $250 for each day, and fined the defendant $4000, or at rate of $50 daily for failure to make proper reports to the commission, as the law prescribes. The latter offense is alleged to have taken place during March, April, May and June.

Roco Refining Company of Kilgore, a Delaware corporation with L. B. Cohen designated as agent, was fined a total of $6600 by Judge Dibrell late Thursday for failure to make reports to the commission and for receiving untendered crude. This conviction boosted the total fines involved in the four cases tried to $19,850.

Attorneys representing defendants receiving stiff fines immediately filed notice of appeal. It is probable that all cases will be carried to the Supreme Court, if necessary to stave off the payment of the fines.

In contrast to the usual procedure in the past when the state launched a belated drive on violators in district court here the Attorney General's department displayed sincerity in trying for convictions. Prosecution of the above cases was conducted by Assistant Attorney General Bailey Sheppard, Edward Clark and H. D. Bishop.

Other cases pending against East Texas plant owners and producers scheduled for trial before Judge Dibrell will probably require another week to clear the docket. In the meantime information is being developed by field representatives of the commission and the Attorney General against current violators.

Regardless of the final outcome of the levied fines, the very fact that the state has displayed an inclination to attempt prosecution is generally believed to be beneficial in so far as thinning the ranks of violators, as there are many operators and company officials engaged in the racket that would not stand trial for the rewards offered by illegal operations.

MARKETS and STATISTICS

Nervous State of Market May Lead to Constructive Pacts

REFINED markets continue in a very nervous state, pending results of concerted action to check the flow of surplus gasoline from the most troublesome districts. Prices were slightly above the extremely low quotations recorded during the previous week, but there was no convincing tendency toward the upward side. The firmer tone in some sections was due more to a smaller supply than to increased demand.

Realization that the extremely low tank truck, tank car, refinery and service station prices can lead only to disaster for marketers of below-cost gasoline is becoming an influence in forcing a number of small refiners to accept a plan which will ultimately raise gasoline prices in general.

Revival of major company support of the East Texas refiners' gasoline market was sent back to the leaders of the independents last week to secure signed commitments from those representing 85 percent of the total plants and 85 percent of the total allocated gasoline produced, as determined by code quotas during an executive session of refiners and marketers at Dallas October 10.

East Texas plant owners are in a more receptive mood to take part and cooperate with a code-sponsored market stabilization plan, after witnessing a temporary drop of tank truck prices on gasoline to an all time low of 1½ cents per gallon. Refiners attending the Dallas meeting expressed the belief that the necessary majority could be signed and a report submitted prior to October 25, the date set by the Planning and Coordinating Committee at Washington early last week for majors to signify their intentions regarding the revival of buying in East Texas.

A chairman of a committee of East Texas plant owners was appointed and the committee will assume the responsibility of obtaining the necessary signatures to revive the tank car market on gasoline, which ranged from two to 2¾ cents per gallon a week ago.

Announcement was made at the Dallas session that the original buying plan of setting a specific price for stored and currently produced gasoline probably could not be resumed. The majors were paying a minimum of four cents when the program was suspended September 28. Substitute measures prohibit the majors from selling gasoline lower than the price quoted in East Texas, while at the same time the East Texas plant owners would not be paid more for their excess offerings than the figure such plants quote to their regular customers. This provision is to eliminate dual prices and directly force the small plants to uphold the price structure.

The supply of surplus North Texas crude has been reduced to a minimum by imposition of more stringent proration quotas, and other Texas districts will also have less surplus oil to absorb in the future.

California

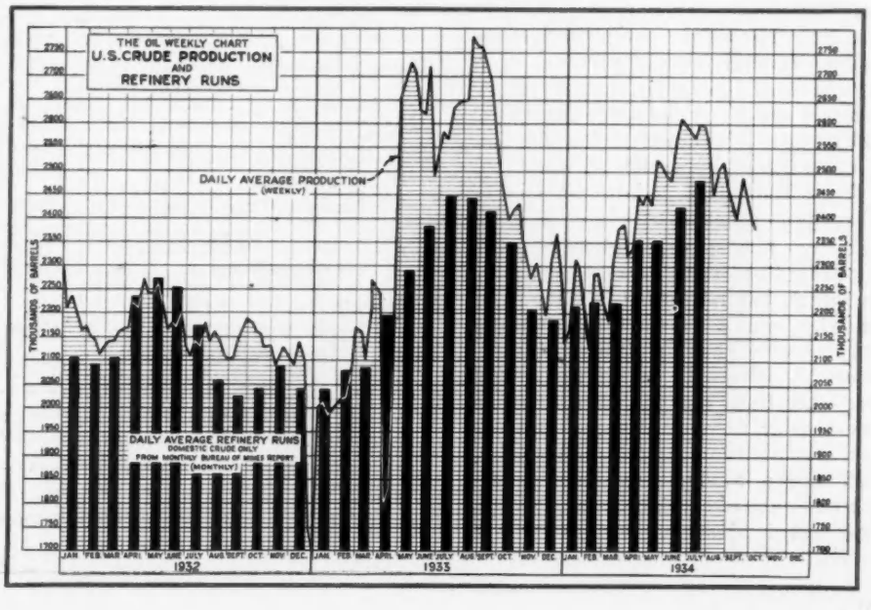
Surplus gasoline in California is being purchased from the independent refiners by the newly established agency, but some of the large marketing companies are not sure that they like the immediate outlook. Both the small and major marketing companies are fighting for gallonage, and these fights in the past have led to serious price cutting. Certain concessions are being made, but the old tank wagon prices still prevail—at least publicly.

Offshore shipments from California points are steady, but largely covered by contracts. Package shipments to the Far East are firm, and there has been little price cutting along this front.

Spot crude is hard to get in most California fields, and there is no immediate danger of a reduction on posted prices.

Oklahoma

The Mid-Continent refined market continues fighting against further inroads of cheap East Texas gasoline in markets ordinarily supplied from Group 3, Oklahoma, refineries, and against the development of a gradually poorer feeling as talk was continued regarding the prospects for an early cut in the price of crude oil. However, those who



have actual influence in the market still hope that something will be done immediately to remedy the situation.

Statistically from all angles the Mid-Continent picture is good. Crude and refined stocks are within designated limits of reasonableness and there remains only the one big obstacle—East Texas. Many of those interested either directly or indirectly in the refined situation are placing much importance on the meeting now being held between Secretary Ickes and the Planning and Coordination Committee.

There is a general feeling in Oklahoma that it is within the power of the federal government to greatly remedy the condition with facility since it has the unquestionable power to regulate interstate shipments. From an Oklahoma observation it appears that efforts of the Texas regulatory body to control production by watching wells and leases will have a questionable result, and that the only hope of success can be expected through control of the outlets.

Products emanating from the East Texas field and reaching only Texas wholesale and retail markets would of course have a depressing effect on that state, but their restriction from interstate commerce undoubtedly would have a very beneficial effect on the market structure as a whole. It is not understood why this move cannot be made, since the government's power to do so has not been questioned. Undoubtedly the present condition cannot continue indefinitely and the only hope for a decided upward turn is through the rigid control of East Texas products. There is a feeling by some Mid-Continent observers that the Planning and Coordination Committee will ask Secretary Ickes to use interstate law in combatting the problem, that it will seek immediate action along this line and if some strong constructive policy is not announced for the immediate future, a crude oil price cut will be announced before the end of the present month.

Prices for refined gasolines were showing a tendency to increase during the week but the turn was though to be based on a gradually diminishing supply rather than upon increasing demand. Third grade motor fuels were the exception with another drop of one-quarter to one-half cent. Burning oils, which during the preceeding weeks had shown a slight weakness under the influence of continued warm weather, rocked along at the established levels.

Bureau of Mines Report for August Reflects Improvement

DEVELOPMENTS during August were mostly favorable, according to the monthly report of U. S. Bureau of Mines. The statistical position of the industry showed a further improvement over July, while the price index for petroleum products during August was 51.6, as compared with 51.3 in July and 40.9 in August, 1933.

Production of crude petroleum in the United States during August totaled 79,058,000 barrels, representing a daily average of 2,550,000 barrels. This average is 81,000 barrels below the July average and 208,000 barrels under the daily average of a year ago.

Texas, California and Oklahoma accounted for the bulk of the August pro-

Supply and Demand of All Oils, from Bureau of Mines August Report on Petroleum

(Thousands of Barrels of 42 gallons)

	Aug. 1934	July 1934[1]	Aug. 1933	Jan.-Aug. 1934	Jan.-Aug. 1933
New Supply:					
Domestic production:					
Crude petroleum	79,058	81,548	85,485	609,286	609,135
Daily average	2,550	2,631	2,758	2,507	2,507
Natural gasoline	3,031	2,945	2,840	23,485	22,036
Benzol[2]	115	122	159	1,142	859
Total production	82,204	84,615	88,484	633,913	632,030
Daily average	2,652	2,730	2,854	2,609	2,601
Imports:					
Crude petroleum	[3]2,527	[3]2,695	3,674	[3]22,895	23,346
Refined products	1,034	1,406	1,678	9,351	9,978
Total new supply, all oils	85,765	88,716	93,836	666,150	665,354
Daily average	2,767	2,862	3,027	2,741	2,738
Increase in stocks, all oils	[4]3,614	3,525	6,492	[4]12,494	28,351
Demand:					
Total demand	89,379	85,191	87,344	678,653	637,003
Daily average	2,883	2,748	2,818	2,793	2,621
Exports:					
Crude petroleum	3,696	4,128	3,141	26,666	23,573
Refined products	5,944	6,143	5,048	49,208	46,152
Domestic demand:					
Motor fuel	38,933	37,395	37,400	268,492	250,517
Kerosene	2,753	2,815	2,791	27,433	23,746
Gas oil and fuel oil	23,891	21,223	25,119	216,118	201,841
Lubricants	1,498	1,491	1,562	12,535	11,041
Wax	53	53	134	603	797
Coke	551	481	969	5,236	6,031
Asphalt	1,745	1,525	1,344	8,451	7,804
Road oil	1,518	1,357	936	5,796	3,340
Still gas (production)	4,234	4,142	4,250	29,335	30,210
Miscellaneous	168	137	148	1,189	1,017
Losses and crude used as fuel	4,395	4,301	4,502	27,591	30,934
Total domestic demand	79,739	74,920	79,155	602,779	567,278
Daily average	2,572	2,417	2,553	2,481	2,334
Stocks:					
Crude petroleum	350,838	355,260	359,945	350,838	359,945
Natural gasoline	4,790	4,551	3,779	4,790	3,779
Refined products	234,091	233,522	256,821	234,091	256,821
Total, all oils	589,719	593,333	620,545	589,719	620,545
Day's supply	205	216	220	211	237

[1]Revised
[2]From Coal Division.
[3]Receipts of foreign crude as reported to Bureau of Mines.
[4]Decrease.

duction decline. The daily average output in California and Oklahoma declined to below the 500,000-barrel mark for the first time in several months. Oklahoma City bore the brunt of the decline in Oklahoma. The East Texas field accounted for the bulk of Texas' decrease for the month.

The number of completions in the East Texas field increased during August, but the number of drilling wells was the lowest since December, 1933. The upward trend in Louisiana production was checked in August but the daily average continued near the 100,000-barrel mark.

The percentage yield of gasoline increased from 43.7 percent of crude run in July to 44.2 percent in August, causing the daily average output of motor fuel to show a further gain of from 1,214,000 barrels in July to 1,230,000 barrels in August. The indicated estimated demand for motor fuel totaled 38,933,000 barrels, a daily average of 1,256,000 barrels. Compared with a year ago this indicates a gain of four percent in domestic demand.

Exports of motor fuel, which had been running behind last year's record, were slightly more than 10 percent higher in August, 1934, than those of a year ago. Total stocks of motor fuel declined about 3,000,000 barrels during the month, the seasonal demand having aided this drop.

Refineries operated during August at 72 percent of capacity, which compared with a ratio of 73 percent in July, but the increased percentage yield of gasoline offset this reduced refinery operation.

The total stocks of refinable crude declined nearly 4,500,000 barrels during August, as compared with a July decline of about 2,000,000 barrels. Stocks on August 31 totaled 350,838,000 barrels. Refined stocks declined to 234,091,000 barrels from 233,522,000 barrels at the end of July. Total petroleum stocks declined during August to 589,719,000 barrels from 593,333,000 barrels at the end of July.

The decline in pipe line and tank farm stocks in the East Texas field continued during August, falling to 30,976,000 barrels from 34,156,000 barrels as of July 31.

Production of natural gasoline increased during August, with a daily average of 4,110,000 gallons. This was three percent above the July production and seven percent above August, 1933.

Crude Production Climbs As Two States Show Sharp Gains

UNITED STATES crude oil production showed a sharp gain during the past week, increasing to a daily average of 2,439,450 barrels, as compared with 2,376,425 barrels during the previous week. These totals do not include allowances for unreported hot oil, which is estimated to be 100,000 barrels daily, or more. This brings the actual indicated production up to a figure far above the October daily allowable of 2,325,800 barrels.

California and Oklahoma accounted for the bulk of the increase, these states ordinarily showing production considerably above their allowables during the first part of a month. Texas showed a smaller production and reflected efforts to meet October allowables.

Oklahoma production increased to 513,200 barrels daily from an average of 420,575 barrels during the previous week. Oklahoma City accounted for the bulk of the state increase with a 58,650-barrel spurt. Seminole showed a daily average increase of 29,850 barrels.

California ran true to form and showed an increase of 26,000 barrels daily over the previous week. This state has a habit of showing excesses during the first part of the month and lower averages during the latter part. Small miscellaneous fields attempt to get their monthly allowables early in the month.

Texas fields showed a decrease of 54,100 barrels, the Gulf Coast and West Texas accounting for a good part of the drop.

Details on production by states and fields appear in the accompanying table.

East Texas Market Shows Strength Late in Week

Tyler, Texas.—Improved market conditions in the East Texas district were in evidence late last week. Producers, transporters and refiners responsible for an estimated average yield of from 90,000 to 100,000 barrels of illegal production daily have been stripped of their usual long profits because of the slump in prices on all products derived from such crude, and are beginning to fear prosecution by both state and federal authorities. Four convictions scored by the state involving fines aggregating $19,850 against three plant owners and a producer, and the tieing up of two tankers of East Texas made gasoline by federal court orders after the cargoes reached their New Jersey destinations, marks the beginning of a long deferred attempt by authorities to harass violators. Persistent rumors credit federal authorities with plans to enjoin middlewestern jobbers from unloading trainload quantities of gasoline shipped from East Texas without proper tendered approvals. A move of this kind would deprive the violators of

Crude Production Takes Trend Upward

The Oil Weekly Estimated Average Daily Production of Crude Oil

District or State	Bbls. Daily for Week Ending Oct. 13	Oct. 6
TEXAS—		
Texas Panhandle	61,100	59,000
North Texas	58,500	59,000
West Central Texas	27,700	27,700
West Texas	140,100	155,200
East Central Texas	43,500	51,200
East Texas Field	411,700	429,100
South Texas	59,500	58,100
Texas Gulf Coast	160,200	177,100
Total Texas	962,300	1,016,400
OKLAHOMA—		
Oklahoma City	184,800	126,150
Seminole Area	119,950	90,100
Tatums	6,000	5,450
Lucien	8,825	6,950
Others	193,625	191,925
Total Oklahoma	513,200	420,575
KANSAS—		
Ritz-Canton	9,550	10,650
Voshell	6,925	5,200
Nikkel Hollow	12,500	12,540
Sedgwick	7,350	7,225
Others	84,225	84,535
Total Kansas	120,550	120,150
LOUISIANA—		
North Louisiana	23,700	23,800
Louisiana Gulf Coast	75,500	75,100
Total Louisiana	99,200	98,900
ARKANSAS	31,200	31,100
CALIFORNIA—		
Long Beach	67,000	60,500
Santa Fe Springs	37,500	38,000
Huntington Beach	40,000	37,500
Dominguez	16,500	17,000
Inglewood	10,000	8,500
Ventura Avenue	22,000	23,500
Seal Beach	6,500	6,500
Midway-Sunset	53,500	53,000
Elwood	10,500	9 000
Kettleman Hills	64,000	56,500
Playa del Rey	8,000	7,000
Others	145,500	128,000
Total California	481,000	455,000
MOUNTAIN STATES—		
Wyoming	38,100	38,500
Montana	10,500	11,000
Colorado	3,200	3,500
Total Rocky Mountain States	51,800	53,000
NEW MEXICO	46,500	46,500
EASTERN STATES	102,000	103,000
MICHIGAN	31,700	31,800
Total United States	2,439,450	2,376,425

Crude Runs to Stills; Finished and Unfinished Gasoline; Gas and Fuel Oil Stocks; and Cracked Gasoline Production, Week Ended October 6, 1934

(Figures in thousands of barrels of 42 gallons each)

DISTRICT	Daily Refining Capacity of Plants			Crude Runs to Stills		Stocks of Finished Gasoline			(c) Stocks of Unfinished Gasoline	(b) Stocks of Other Motor Fuel	Stocks of Gas and Fuel Oil	Daily Charging Capacity of Cracking Units			Cracked Gasoline Production
	Potential Rate	Reporting		Daily Average	% Operated	At Refineries	Bulk Term., in Trans. & Pipe Lines	Total at Refys., Term., etc.				Potential Rate	Reporting		Daily Average
		Total	%										Total	%	
East Coast	582	582	100.0	428	73.5	4,392	8,905	13,297	858	230	14,507	496	471	95.0	65
Appalachian	150	140	93.3	88	62.9	711	806	1,517	265	110	1,669	69	69	100.0	23
Ind., Ill., Ky	446	422	94.6	280	66.4	3,277	3,187	6,464	859	40	5,016	325	309	95.1	89
Okla., Kans., Mo	461	386	83.7	202	52.3	2,296	1,637	3,933	443	695	3,691	256	238	93.0	50
Inland Texas	351	167	47.6	73	43.7	809	82	891	241	620	1,440	82	66	80.5	19
Texas Gulf	566	552	97.5	443	80.3	3,385	307	3,692	1,110	165	10,936	358	355	99.2	96
Louisiana Gulf	168	162	96.4	116	71.6	738	595	1,333	181	5	3,023	71	71	100.0	18
North La.,—Ark	92	77	83.7	43	55.8	187	29	216	71	30	595	41	38	92.7	7
Rocky Mountain	96	64	66.7	27	42.2	483	.....	483	115	40	537	46	42	91.3	7
California	848	822	96.9	384	46.7	9,465	2,069	11,534	790	2,285	74,145	209	209	100.0	49
TOTALS WEEK: October 6, 1934	3,760	3,374	89.7	2,084	61.8	25,743	17,617	43,360	4,933	4,220	115,529	1,953	1,868	95.6	423
September 29, 1934	3,760	3,374	89.7	2,151	63.8	26,781	17,069	43,850	5,055	4,240	*115,398	1,953	1,868	95.6	460

Below are set out estimates of Crude Runs and Cracked Gasoline Production on B. of M. Basis for Week Oct. 6, 1934, compared with Oct. 1933 Bureau figures.

Estimate B. of M. Basis Oct. 6, 1934	2,255		470
Estimate B. of M. Basis Sept. 29, 1934	2,320		510
U. S B. of M. October 1933: Daily Average Crude Runs	2,434	U. S. B. of M. October 1933. Daily Average Cracked Prod.	516

(a) Amount of unfinished Gasoline contained in Naphtha Distillates.
(b) Estimated. Includes Unblended Natural Gasoline at refineries and plants; also Blended Motor Fuel at plants.
*On new basis. 180,000 barrels re-classified in Indiana-Illinois-Kentucky district.

Summary of Field Results During Past Week

State	Completions	Oil wells	Gas wells	Failures	Init. prod.
Arkansas	2	1	0	1	300
California	9	9	0	0	6,120
Colorado	3	0	0	3	0
Kansas	19	12	1	6	7,575
Kentucky	39	30	0	9	2,390
Louisiana	25	15	1	9	8,570
Michigan	8	4	1	3	800
Montana	3	3	0	0	140
N. Mexico	1	1	0	0	600
Ohio	66	28	27	11	380
Oklahoma	41	23	4	14	18,935
Penn'slva	6	3	2	1	45
Texas	160	123	4	33	555,670
W. Va.	35	10	20	5	455
Wyoming	1	1	0	0	3,000
Total	418	263	60	94	605,000

Comparison of Permits Granted for New Wells

State	Week ending Oct. 13	Total Total month	Total this year	Total date last year	Total this 1933 year total
Arkansas	4	6	75	39	47
California	21	39	517	477	593
Louisiana	19	29	625	603	755
Kansas	13	32	513	511	682
Michigan	9	15	355	336	420
Oklahoma	44	94	1,590	906	1,315
Texas	171	176	9,150	5,946	7,845
Total	281	491	13,143	8,818	11,651

their greatest market outlet, now that the government has begun impounding deliveries to the Atlantic Coast. East Texas plant owners have been losing gasoline gallonage in Texas through the majors' displaying a willingness to cut the retail price on all grades in proportion to the slashes instituted by the independents in trying to create added outlets for surplus products. Record low prices appeared during the past week in many Texas cities, with Dallas, an important market for East Texas plants, retailing the three grades at 9, 11 and 13 cents, including five-cent tax. Wholesale prices on U. S. motor grade gasoline sold by East Texas plants had increased to an average of about 2½ cents per gallon late last week, with a few small plants selling at two cents to avoid shutting down. Fuel oil prices have dropped below 20 cents per barrel, or less than 50 percent of the normal level. Other products have slumped proportionately in price. East Texas plants were credited with processing an average of about 100,000 barrels of crude daily during the past week, while their combined supply of legal crude is estimated at 15,000 barrels daily. Many plant owners that have producing properties prefer to sell their allowable production from same to majors at $1 and operate their plants on purchased oil that is still obtainable at 25 cents per barrel, when proration restrictions are sidestepped. Definite progress was made within the past week to win the support of the requisite 85 percent of the plant owners in signing up to comply with oil code restrictions as a means of reviving the major company gasoline buying program. Refiners that have heretofore refused to participate in an oil code-sponsored buying plan have signified their intensions to cooperate. Demoralizing conditions confronted by refiners in recent weeks have been almost intolerable, and a return of a stable market is now sincerely desired by the majority.

MRS. BERRY V. STOLL, wife of the president of Stoll Oil Refining Company, Louisville, Kentucky, was kidnapped from her home October 11 and held for $50,000 ransom. She was beaten by the abductor who gained entrance to the house on a pretext. The ransom was reported paid October 12, but Mrs. Stoll had not been returned by her abductors.

Crude Oil Price Quotations

(Figures Represents Basic or Flat Prices—Revised to October 12, 1934)

DISTRICT	Low Grav.	Dif.	High Grav.	Date
Oklahoma-Kansas	28—$ .84	2¢	40—$1.08	9-29-33
N. and N.-C. Texas	28— .79	2¢	40— 1.03	9 29-33
Texas Panhandle				
Gray County	34— .79	2¢	40— .91	9-29-33
Carson-Hutchinson	34— .69	2¢	40— .81	9 29-33
West Texas				
Ector, Pecos, Wk'lr.	*.75			9-29-33
Crane, Upton, Howard and Glasscock	*.70			9-29-33
East Texas	*1.00			9-29-33
Texas Gulf Coast				
Conroe	35— 1.09	2¢	40— 1.19	9-29-33
Tomball	*1.15			9 29-33
Cleveland	*1.00			1-11-34
†Goose Creek, Hull Liberty, Orange, Pierce Junction, Moss Bluff, Raccoon Bend, Sour Lake Spindletop, Sugarland, West Columbia, Humble, Rabbs Ridge	Below 20— .82	2¢	34— 1.12	9-29-33
South and SW Texas	Below			
Refugio (Light)	20— .82	2¢	34— 1.12	9-29-33
Refugio (Heavy)	*.95			9-29-33
Saxet	*.85			9-29-33
Mirando	*.80			9-29-33
Pettus	*1.05			9-29-33
Salt Flat	*.87			9 29-33
Darst Creek	*.87			9-29-33
Arkansas				
El Dorado (Light) and Rainbow	29— .79	2¢	40— 1.03	3-17-34
El Dorado East Field and Smackover	*.70			9-29-33
North Louisiana	29— .79	2¢	40— 1.08	9-29-33
Urania	*.85-*.87			1- 1-34
South Louisiana	Below			
Lockport	20— .80	2¢	34— 1.10	9-29-33
Iowa, Cameron Mds.	Below 20— .70	2¢	34— 1.00	9-29-33
Rocky Mountain States				
Salt Creek	29— .84	2¢	40— 1.08	9-29-33
Elk Basin	*1.17			9 29-33
Grass Creek (Light)	*1.17			9-29-33

*All gravities—flat rate.
†Gulf Coast prices as posted by Humble Oil & Refining Company.

DISTRICT	Low Grav.	Dif.	High Grav.	Date
Big Muddy	*$1.01			9-29-33
Rock Creek	*1 02			9-29-33
Sunburst	*1 35			9-29 33
Lance Creek	*1.02			8 25-33
Osage	* 62			8-25 33
Cat Creek	* 45			8-25 33
Pondera	*.65			8-25-33
Hog Back, N. M.	*1.00			9- 8 33
Lea County, N. M.	*.75			9-29-33
Mid-West States				
Lima	*1.30			9-29-33
Illinois	*1.13			1- 5 34
Princeton	*1.13			1- 5-34
Western Kentucky	*1.17			9-29-33
California				
Signal Hill	14— .65	1¢	16— .66	9- 6 33
	17— .68	2¢	22— .84	9- 6 33
	23— .88	3¢	30— 1.09	9- 6-33
Seal B., Alamitos Hts.	19— .65	3¢	20— .68	9- 6 33
	21— .72	4¢	22— .76	9- 6 33
	23— .81	4¢	26— .93	9- 6-33
	27— .98	4¢	30— 1.10	9- 6-33
Huntington Beach	14— .65	4¢	15— .69	9- 6-33
	16— .72	3¢	19— .81	9- 6-33
	20— .83	3¢	28— 1.07	9- 6 33
	29— 1.09	3¢	30— 1.12	9- 6-33
Inglewood	14— .65	4¢	16— .73	9- 6-33
	17— .76	4¢	18— .80	9- 6-33
	19— .83	4¢	20— .87	9- 6 33
	21— .90	4¢	22— .94	9- 6-33
	23— .97	4¢	24— 1.01	9- 6-33
Playa del Rey	14— .65	1¢	15— .66	9- 6-33
	16— .69	4¢	17— .73	9- 6-33
	18— .76	4¢	19— .80	9- 6-33
	20— .83	1¢	21— .87	9- 6-33
	22— .90	4¢	23— .94	9- 6-33
	24— .97	3¢	25— 1.00	9- 6-33
			26— 1.04	9- 6-33
Olinda-Brea Canyon	14— .65	4¢	16— .73	9- 6-33
	17— .76	3¢	28— 1.10	9- 6-33
Athens-Rosecrans Domingues	23— .83	3¢	24— .86	9- 6-33
	25— .90	4¢	26— .94	9- 6-33
	27— .97	3¢	29— 1.04	9- 6-33
	30— 1.08	4¢	31— 1.12	9- 6-33
			32— 1.15	9- 6-33
Elwood (fob ship.)	33— 1.03	3¢	37— 1.15	9- 6-33
Torrance	14— .65	1¢	15— .66	9- 6-33
	16— .69	3¢	20— .81	9- 6-33
	21— .83	3¢	26— .98	9- 6-33

*All gravities—flat rate

DISTRICT	Low Grav.	Dif.	High Grav.	Date
Richfield	15— .65	2¢	16— .67	9- 6-33
	17— .70	4¢	20— .82	9- 6-33
	21— .85	4¢	22— .89	9- 6-33
	23— .93	4¢	24— .97	9- 6-33
	25— 1.00	4¢	27— 1.08	9- 6-33
	28— 1.11	4¢	29— 1.15	9- 6 33
Whittier-LaHabra	15— .65	3¢	18— .74	9- 6-33
	19— .78	3¢	24— .93	9- 6-33
Montebello	19— .65	1¢	20— .66	9 6-33
	21— .69	3¢	22— .72	9- 6-33
	23— .76	4¢	24— .80	9 6-33
	25— .85	4¢	26— .89	9- 6-33
Coyote Hills	16— .65	3¢	19— .74	9- 6 33
	20— .78	3¢	29— 1.05	9- 6 33
	30— 1.09	3¢	34— 1.21	9- 6-33
Santa Fe Springs	21— .72	4¢	22— .76	9- 6-33
	23— .79	4¢	25— .87	9- 6 33
	26— .90	4¢	28— .98	9- 6-33
	29— 1.01	4¢	30— 1.05	9- 6-33
	31— 1.08	4¢	33— 1.16	9- 6-33
	34— 1.19	4¢	35— 1.23	9- 6-33
	36— 1.26	4¢	38— 1.34	9- 6-33
New Hall, McKittrick, Kern River	14— .57		19— .57	9- 6-33
Midway-Sunset, Elk Hills, Buena Vista Hills	17— .57	4¢	18— .61	9- 6-33
	19— .64	3¢	22— .73	9- 6-33
	23— .77	4¢	33— 1.17	9- 6-33
Lost Hills	17— .57	4¢	21— .73	9- 6-33
	22— .76	3¢	30— 1.00	9- 6-33
Coalinga	17— .57	1¢	18— .58	9 6-33
	19— .62	3¢	21— .68	9- 6-33
	22— .72	3¢	25— .81	9- 6 33
Wheeler Ridge	17— .57	1¢	18— .58	9- 6-33
	19— .61	3¢	25— .79	9- 6-33
Kettleman Hills	33— 93	3¢	39— 1.11	9- 3 33
Pennsylvania				
Bradford	*2.25			4- 1-34
Sw Pa. Pipe Line	*2 22			4- 1-34
Eureka Pipe Line	*2.17			4- 1-34
Buckeye Pipe Line	*2 07			4- 1-34
Corning Grade	*1.20			9-11-33
Michigan				
Central Michigan	*1.20			9-30-33
M skegon	*.70-1.00			12-31-32
Canada				
Petrolia	*2.10			9- 9-33
Oil Springs	*2.17			9- 9-33

*All gravities—flat rate.

Start Work on Gas Line From Long Lake Field

Dallas, Texas.—Construction work has been started on a 75-mile 12-inch natural gas line previously announced as having been authorized by Lone Star Gas Company in connecting its Central Texas trunk line system with the Long Lake field, southwestern Anderson County. The line will tie into the company's system at Riesel junction, near Waco.

The A. F. Day Construction Company, Dallas, was given the contract to construct the line, using two crews on opposite ends to speed up completion. The welded pipe for this unit was salvaged from surplus lines owned by Lone Star Gas Company in Texas and Oklahoma. The pipe was run through cleaning machines prior to shipment, and is also to be given a second workover before being insulated and wrapped.

Lone Star Gas Company has a long term contract to purchase a minimum yearly volume of gas from Tide Water Oil Company and Texas Seaboard Oil Company's Monning discovery lease in the Long Lake field, and is also negotiating for a contract on the gas production of H. L. Hunt et al's big gasser, located several miles northeast of the five-well field.

Young Engineers Club Meet With A.I.M.E.

Tulsa.—The Young Engineer's Club of Tulsa held its October meeting on Friday and Saturday, October 12 and 13 in conjunction with the annual meeting of the Production Division, American Institute of Mining and Metalleurgical Engineers.

MAJOR PRICE CHANGES

	Penna. (Nat. Tr.)	Mid-Cont. (36 Gr.)	Calif. (26 Gr.)
March 5, 1933	.....	.....	Cut 24.
May 2, 1933	.....	Cut 19.	.....
May 9, 1333	Cut 20.	.....	.....
May 22, 1933	Up 10.	.....	.....
June 19, 1933	Up 10.	Up 19.	.....
June 26, 1933	Up 10.	.....	Up 9-12
July 6, 1933	Up 13.	Up 10.	.....
July 17, 1933	Up 15.	.....	.....
July 28, 1933	Up 15.	.....	.....
August 11, 1933	Up 10.	.....	.....
August 24, 1933	.....	Up 10.	.....
August 30, 1933	Up 15.	.....	.....
September 6, 1933	Up 10.	Up 10.	Up 15.
September 8, 1933	.....	Up 15.	.....
May 1, 1934	Up 10	.....	.....

CRUDE PRODUCTION TAXES

Oklahoma—Three percent of gross value less royalty interest.

Texas—Two cents or 2 percent, whichever is higher.

Louisiana—From four to 11 cents a barrel, depending upon gravity.

Arkansas—2.6 percent of gross market values.

Montana—Three percent of gross value at well and ¼-cent per barrel.

Wyoming and New Mexico—Production tax based upon state and county assessments.

California—.66443 mills per barrel of oil produced and 17.39 cents per acre on proved oil lands.

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German Critical *of Government Regulation in* Talk to Engineers

Tulsa.—One year under the oil code has taught oil men that there are dangers present in a permanent set-up of federal inter position, and there is a growing aversion to governmental meddling with business, W. P. Z. German, counsel for Skelly Oil Company, told members of the American Institute of Mining and Metallurgical engineers Friday night at their informal banquet.

The speaker made it clear that the views he advanced were his own, he not being authorized to express those of his company on the question.

German called attention to the failure of federal authorities to stop excess oil production, and to the extension of federal control efforts to refining and marketing divisions and even to contractural relations between employer and employe. He asked if politicians could resist the temptation to make the industry a footstool to toy and play with should federal interposition be made permanent and be limited initially to an effort to curb excess oil production.

"The one year's experiment has taught us that there are dangers present in a permanent set-up of federal interposition. In the first place, the federal authorities acting under the recovery act have not yet put a stop to excess oil production, and, hence, have done little, if any, more than the states, acting under their police power, to accomplish the eradication of the disease afflicting the industry. It is the old story of not quite enforcing a good law. In the second place, the federal effort has been extended to refining and marketing and even to contractual relations between employer and employee. No state has extended its efforts into any of these fields and no state is likely to attempt to do so. If federal interposition were made permanent and were initially limited to an effort to treat the cancerous heart of the disease, excess oil production, would it stop there, once at work on the fascinating subject? With its opportunities for expansion of control of a vigorous, widely-expanded business, could politicians, led at time by over-enthusiastic members of the industry acting on the spur of the moment's impulse, resist the temptation to make of it a footstool to toy and play with? Many good men in the industry heartily favored the Disney bill last May; but now, many of those same men, reflecting, in calmer moments, upon the possibilities involved, have let their natural aversion of governmental meddling with business lead them into a conviction that the national government should not do more than consent to a state compact for co-operative effort to control crude oil production. Were these men right last May, or are they right now? Echo answers, 'were they right last May, or are they right now.'"

New Gasoline Contracts *Planned By Committee* Before October 25

Washington, Oct. 10.—Negotiation of new contracts for the buying of distress gasoline will be undertaken by the program committee of the Planning and Coordination Committee on or before October 25, provided four conditions set forth by the committee are complied with, it has been announced.

Members of the buying group of the industry were this week asked by the committee to report by telegram whether they approve of the resumption of negotiations, which were suspended late last month because through lack of enforcement the production of illegal oil was not being shut off. It was claimed that within a period of 45 days East Texas production increased from 700,000 to 1,200,000 barrels a day.

As a result of the suspension of the stabilization program, the situation with respect to gasoline is today "wide open" and it is freely predicted that if buying negotiations are not resumed this month the price structure will be "shot to pieces" within 48 hours after the October 25 deadline is reached.

The four conditions laid down by the Planning and Coordination Committee as a requisite for the resumption of negotiations are that "the enforcement measures now being instituted in East Texas give

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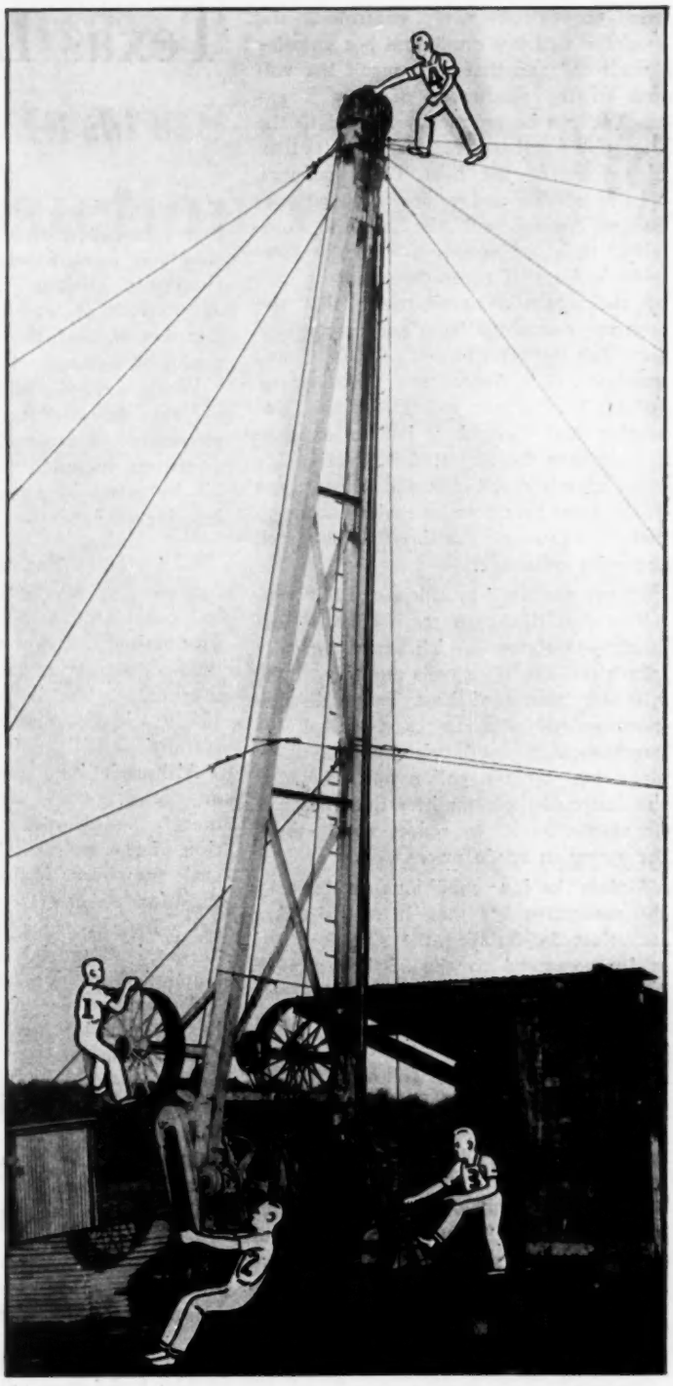

With this sturdy, mobile machine—the Moore Type 10 Spudder—cleaning out old wells is accomplished easily and economically without the use of a derrick or standard rig front. It is also inexpensive equipment for drilling wells to a depth of 2500 feet.

Light in weight, with wide-tired wheels (1), it is easily moved from well to well by a tractor, which also supplies power for operation. An efficient drilling motion is produced by the crank and spudding arm (2). Convenient location of operating levers (3) assures easy control of the machine. There are bronze bushed bearings in crown and sand line pulleys (4). Where a pumping derrick is over the well, the Moore Spudder is furnished with a stub frame to go under the bull wheel girt. Write for details.

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assurance of effectively controlling the production of hot crude and hot gasoline therefrom" and that as a result the volume of the production of East Texas gasoline can be practically limited to the allocation for that area; that not less than 85 percent of the East Texas refiners, both in number and volume of legal production, record with the program committee their willingness to sign the committee's form of contract for all or part of their gasoline production; that the program committee have adequate assurance that the total output of East Texas gasoline will be limited to a maximum of 700,000 barrels per month through November and December, but in no case greater than the allocated production for those months; and that the price clause in the term contracts be revised so as to make the price of gasoline fluctuate with the price of crude.

It was explained by officials of the committee that the contracts negotiated last month—15 of them which would normally take about 275,000 barrels monthly of the 1,100,000 barrels of East Texas distress gasoline estimated to exist—called for purchase at a fixed price ranging from about two cents a gallon upward. It is the desire of the committee that the price be elastic, so as to reflect at all times the swing in crude prices.

Unless the four conditions set down by the committee are met, it will abandon its effort to stabilize the situation and will recommend to the 15 buyers now having contracts that they avail themselves of the 30-day cancellation clause therein.

Observers who have followed the oil situation are skeptical of any concrete results from the committee's announcement and believe that not only will it be impossible for the government to secure adequate enforcement of production control by October 25, but also that it will not be possible to get the 85 percent of approvals required, to say nothing of an agreement to a flexible price plan.

Tulsa.—Hearings before the Petroleum Labor Policy Board started here on Wednesday, October 10, on which date Chairman George W. Stocking and Dr. John Lapp, board members, heard the case of Johnson Oil & Refining Company. Thursday and most of Friday were devoted to the taking of testimony in the dispute of organized labor with owners of stripper well production. The hearing was concluded late Friday after testimony had been completed in the case of Continental Oil Company. Decisions were withheld and at the time of departure of board members no satisfactory definition of stripper production had been advanced.

Texas Legislature *in Session With Eye on* More Tax from Oil

Austin, Texas.—The Texas Legislature was called into extraordinary session last week for the fourth time by Governor Miriam A. Ferguson. The announcement was made on Monday, October 8, and the session was convened at noon on Friday.

While relief measures, including projects designed to relieve the unemployment situation, were the principal questions included for submission, the oil industry is almost certain to be interjected into the session.

Taxation

State Comptroller George Sheppard has completed a draft of a new gross production tax law which he will ask the legislature to pass. Defects in the present statute, known as House Bill 154, would be corrected in the bill the comptroller will offer.

Although its sponsor contemplates no change in the rate of taxation, but merely an improvement in the collection of the tax as it is now levied, several members indicated clearly that they favored a material increase in the tax when the measure was submitted at the last special session which was concluded on September 27.

A tax increase of only one cent per barrel would mean an increase of 50 percent on the tax now paid by the producers on crude oil. The source of revenue is certain, and the increase of this levy would not require the establishment of an agency for collection purposes. The state could obtain the revenue with the current staff, so that all of the increased income would all be available to defray expenses of relief, the proposed centennial appropriation, and other expenditures.

Regulation

The legislature will be asked to create a special district court in East Texas which would try oil penalty cases exclusively. Such an act would receive the support of all the enforcement agencies. They have encountered great difficulty in bringing to trial many of the thousands of cases which they have filed and which now congest the dockets of the district courts extant in the area.

The special court over which presides Judge Renne Allred, brother of the attorney general, expires in November. The legislature will probably be asked to extend the term of this court.

The special penalty court was proposed in a bill introduced at the last special session, but was never reported out of committee. Representative Sidney Latham of Longview was the sponsor of the measure at that time, and will probably introduce the bill again.

Sponsors of the law passed at the last session providing for tenders on the movement of processed crude oil may reintroduce that bill in an effort to bring about its immediate effectiveness. As enacted, the measure does not become effective until December 25, ninety days after the signature of the Governor was appended. Sponsors of the law point out that the federal agencies have recently indicated a much more active interest in enforcement of the oil code preventing the movement of hot oil interstate, and for that reason the state enforcement bodies should be given every tool with which to work.

Experienced observers believe that nearly every sort of bill will be introduced before the session concludes at the end of 30 days. The final clause in the proclamation from the governor provided for the consideration of "such other matters as the governor, from time to time, may care to submit."

This, as well as the fact that the Governors Ferguson are within 90 days of the end of their political life, was taken as an indication that general matters will be considered as well as the special subjects submitted in the call.

Vast appropriations will be needed to meet the expenditures proposed by the governor for the centennial, relief, irrigation and power projects; the members will demand the right to introduce their pet measures before they will agree to support these plans.

Washington.—Allowable gasoline production for November will be 33,180,000 barrels, according to orders issued October 11 by Oil Administrator Harold L. Ickes.

This is an apparent reduction of 510,000 barrels as compared with the October allocation, but is actually an increase of 19,000 barrels in the daily quota because of the shorter month, it was explained.

No withdrawals from gasoline stocks will be required during November, it was disclosed.

Pneumatic-Tool Lubricants can affect Construction Costs

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New Oklahoma Work Scattered Over State

Tulsa. — New work in Oklahoma showed a slight decline during the week but that activity was becoming more widely distributed over the state was shown by the fact that again a large number of counties were represented in the list of first reports. Okmulgee County led the state with seven starts, Osage and Seminole were tied for second place with five each and Creek and Pottawatomie had four each. Lincoln and Pontotoc fell in the next division with three first reports each; Muskogee, and Stephens had two each; and Beckham, Caddo, Carter, Grady, Jefferson, Murray, Oklahoma, Pawnee, and Tulsa had one each, a total of 18 scattered counties and a total of 44 first reports compared to 50 for the preceding week.

The completion list included 23 oil wells with total initial production of 18,935 barrels, four dry gas wells with combined initial volume of 17,750,000 cubic feet, two abandoned locations and 12 dry holes, a total of 41 completions which involved 103,439 feet of drilling of which 825 feet were in three old wells. With the major companies becoming more active in their own operations and showing a willingness to help smaller operators by contributing to tests, the state seems slated for a reasonable amount of development during the remainder of the year, predicated on the assumption that some way will be found to control production in the East Texas field and thereby avert a threatened cut in the price of crude oil.

Reports of the week were as follows:

Company, Well and Location	Init. Prod. Bbls.	Depth
CARTER COUNTY—		
Carter Oil Co, Wm. Bonner 1, se nw ne 19-3s-2w	*	4018
CREEK COUNTY—		
Samples & Mann, Rentie 1, ne ne sw se 32-19n-9e (owdd)	¶9	2949
Johnson Oil Refining Co, A. Scott 1, nw nw ne nw 32-19n-9e	*	3030
William Sherry, Crawford 1, se se se nw 28-19n-9e	*	2797
Fred Grey et al, Morgan 1, ne ne nw se 36-19n-8e	*	2590
C. W. Titus, Casey 5, ne ne se sw 3-17n-8e	125	1355
HUGHES COUNTY—		
Mid-Continent Oil Co, Factor 10, cnl nw se 15-7n-8e	30	1199
Manahan Oil Co, Chapman 6, se ne sw 10-7n-8e	12	2950
J. B. Hill et al, Perkins 1, cw½ sw sw 7-5n-9e	*	1075
JACKSON COUNTY—		
Gypsy Oil Co, Stokes 1, se nw sw 11-1n-20w	*	1723
JEFFERSON COUNTY—		
Farlyn Oil Co, Seay 22, nw sw se se 3-7s-5w	32	1227
LINCOLN COUNTY—		
Slick-Urshel & Stanolind Oil, Kentzleman 6, ne nw sw 7-14n-4e	1680	5094
Magnolia Petroleum Co, Benedict 5, sw sw nw 7-14n-4e	1020	5095
Stanolind & Amerada, M. Craig 1, ne se nw 12-14n-3e	187	4971
MARSHALL COUNTY—		
R. A. Godfrey, Eppler 3, ne nw ne ne 36-7s-5e	21	519
OKFUSKEE COUNTY—		
Kirkpatrick, Robinson 1-A, se se sw se 26-11n-11e	¶3¾	2356
Fleming, Pincham 5, ne nw se se 2-10n-11e	40	1658
OKLAHOMA COUNTY—		
Phillips Pet, Hostein 3, ne sw se 22-11n-3w	1734	6575
Knox-Garvin et al, Centra Addition 1, nw se se 3-11n-3w	409	6401
Watchorn Oil & Gas, Traders Compress 2, ne nw se se 34-12n-3w	6012	6409
OKMULGEE COUNTY—		
C. Lambert et al, Call 1-A, sw se nw 24-16n-14e (owdd)	¶2	1900
Sheridan, Thompson 1-A, cnl se nw 24-16n-11e	¶3	2388
Ford & McDugal, Brown 1, ne sw se nw 27-15n-13e	*	860
Harmon Brothers, Culp 1-A, cel sw nw 8-15n-12e	*	650
Rounsville, Rentie 8, se se ne se 30-12n-12e	3	1238
Cusack, Rentie 1-A, ne ne se se 30-12n-12e	3	1229
OSAGE COUNTY—		
Carter Oil Co, Cook 2, ne ne ne ne 9-25n-6e	1108	2730
PONTOTOC COUNTY—		
Blanchard et al, Crabtree 1, ne se ne 27-2n-6e	*	2920
Blackstock et al, D. Hardin 2, ne se nw 30-2n-7e	4416	4480
Mason et al, Mallory 2, sw nw nw 30-5n-5e (owdd)	100	2553
POTTAWATOMIE COUNTY—		
Haliburton, Pierson 4, sw se ne 9-7n-4e	240	3768
Jones, Lucas 2, sw ne nw 2-6n-4e	15	4280
SEMINOLE COUNTY—		
Champlin Refining Co, See 4, se sw ne se 30-7n-8e	lcn.	abd.
Carter Oil Co, Magruder 1, ce½ sw sw 2-9n-6e	256	4012
Crafton, Strothers 1-A, cel ne se 3-9n-6e	lcn.	abd.
Mid-Continent Oil Co, Marcy 1, sw sw nw 13-9n-6e	815	4050
Carter Oil Co, Grisso 1, cn½ se ne 2-10n-6e	*	4452
Douglas 1, cwl sw nw 18-10n-6e	662	4590
STEPHENS COUNTY—		
Finley et al, Woolsey 1, nw nw se 10-3s-6w	*	444
TULSA COUNTY—		
Crews-Armstrong, Barnett 1, nw nw sw se 8-16n-14e	15	1596
R. O'Neal, Lewis 1, se ne nw 36-17n-14e	*	1885

*Failures; †Junked; ¶Million cu. ft. gas.

Oil and Gas Association Meets October 16

Tulsa.—Announcement has been made of the annual meeting of the Kansas-Oklahoma Division, Mid-Continent Oil and Gas Association, to be held here in the association assembly room, 309 Tulsa Building, on Tuesday, October 16, 1934. The meeting will be strictly a business meeting dealing with association matters and will determine in a large part the program and policies of the division for the ensuing year. One of the important matters to be before the meeting is the election of the executive committee.

Objectionable Indian Lease Clause Modified

Muskogee, Oklahoma. — Objections by the industry to the revised lease form promulgated by the Department of Interior on October 10, 1933, have been recognized and a new clause has been provided to eliminate one of the most objectionable requirements. In announcing a sale of oil and gas leases on restricted lands belonging to the Five Civilized Tribes, to be held here at 10:00 a.m., Thursday, October 25, superintendent A. M. Landman has announced that leases must be executed on the revised 1933 lease form, but if so desired a sticker may be attached eliminating the so-called one year drilling clause. The sticker pertaining to the lease drilling clause will be as follows.

"The lessee hereby agrees (1) to drill and produce all wells necessary to offset or protect the leased land from drainage by wells on adjoining lands not the property of the lessor, or in lieu thereof, to compensate the lessor in full each month for the estimated loss of royalty through drainage; provided, that during the period of supervision by the Secretary of the Interior, the necessity for offset wells shall be determined by the officer in charge and payment in lieu of drilling and production shall be with the consent of said secretary and in an amount determined by the officer in charge;

(2) at the election of the lessee to drill and produce other wells; provided, that the right to drill and produce such other wells shall be subject to any system of well spacing or production allotments authorized and approved under applicable law or regulations approved by the Secretary of the Interior affecting the field or area in which the leased lands are situated;

and (3) if the lessee elects not to drill and produce such other wells for any period, the Secretary of the Interior may, within 10 days after due notice in writing, either require the drilling and production of such wells to the number necessary, in his opinion, to insure reasonable diligence in the development and operation of the property or may in lieu of such additional diligent drilling and production require the payment of not to exceed $1.00 per acre per annum, which sum shall be in addition to any rental or royalty hereinafter specified; Provided, that the amount of the additional rental for delayed development or production so paid for any one year may be credited on the royalty for that year.

The leases may be executed on the

present form with the understanding that they may be transferred to the new form when approved, pursuant to section 38 of the oil and gas leasing regulations approved July 7, 1925. Said section reads as follows: The lessee under any lease heretofore approved may by stipulation, with the consent of the lessor and the approval of the Secretary of the Interior, make such approved lease subject to all the terms, conditions, and provisions contained in these regulations and in the lease form authorized and adopted in pursuance thereof."

Sale October 25

The sale of October 25 brings the largest offering of the past several years with 175 tracts totaling 15,452.54 acres placed on the list. Of the 22 counties in which the lands are situated Coal County with 31 tracts totaling 3,436.81 acres and Pontotoc County with 30 tracts totaling 2,583.61 acres, lead in size of offering. Other counties, number of tracts and acreage in each, are as follows:

Jefferson, seven tracts, 710 acres; Stephens, one tract, 100 acres; Grady, 14 tracts, 1,304.49 acres; Craig, two tracts, 40 acres; Washington, one tract, 50 acres; Cherokee, five tracts, 700 acres; Tulsa, four tracts, 280 acres; Creek, 12 tracts, 930.79 acres; Wagoner, five tracts, 360 acres; Okmulgee, four tracts, 280 acres; Muskogee, one tract, 120 acres; Okfuskee, 11 tracts, 800 acres; Seminole, four tracts, 110 acres; Hughes, 13 tracts, 1,069.49 acres; Pittsburgh, one tract, 160 acres; Johnson, three tracts, 290.13 acres; Garvin, 16 tracts, 1,280 acres; McClain, five tracts, 390.35 acres; Murray, one tract, 40 acres; and Carter, four tracts, 416.87 acres. Activity in the Franks Graben area of Pontotoc and Coal Counties accounts for the large offering in those counties.

Kansas A.P.I. Chapter Meets at Newton

Newton, Kansas.—The regular October meeting of the Kansas Chapter, American Petroleum Institute will be held here on Thursday, October 18, at the Newton Chamber of Commerce rooms. The meeting will open with a dinner at 6:30 at the Hotel Ripley. This will be followed by a business and technical meeting and the session will be closed with entertainment furnished by the Chamber of Commerce. In view of the central location of the October meeting a large attendance of oil men from all parts of the state is expected.

Carter Oil Spends Five Million in Fitts Area

Tulsa.—Carter Oil Company verified during the week its purchase of 540 acres of developed and undeveloped acreage in the Fitts area of Pontotoc County, bringing to a close one of the largest lease transactions that has transpired in the Mid-Continent area in several years. Although details of the transaction were not made public it is said that total consideration was $5,200,000 of which $1,000,000 was in cash and the remainder to be paid over a period of 25 years not contingent upon production and in the form of bonds bearing the usual rate of interest. Included in the purchase are two shallow gas wells and one deep sand oil well.

The story on the sellers' side of the transaction is an interesting one. W. A. "Gus" Delaney, Ada attorney who was formerly at Allen, Oklahoma, became interested in the oil business during the time of development of the Allen pool on Pontotoc County. Subsequently he drilled a gas well but previous to discovery of production at Fitts he had followed a legal practice and dealt in the oil business as a side line. B. C. King, also an Ada attorney, became associated with Delaney, and did the title work on the block which was sold to Carter. When the partners came to the point of drilling their first test in the block Sam S. Miller, a dealer in second-hand oil field materials, was taken into the partnership for having furnished some of the materials. The first test, W. A. Delaney et al's Richards 1, C NW NW SE 30-2n-7e, had 7,000,000 cubic feet of gas at 1285 feet, 15,000,000 cubic feet at 1354 feet with a big increase in gas at 1621 feet, the top of the Cromwell sand. It was completed on April 11, 1933, for 50,000,000 cubic feet of gas at 1700 feet.

The first deep test was drilled by J. C. Shaffer, W. A. Delaney et al on the Hardin farm, C NE NW SW 30-2n-7e. This test found Wapanucka lime at 1945 feet and had 50,000,000 cubic feet of gas at 2295 feet. At this depth the well blew out of control, cratered badly and had to be plugged with cement and abandoned. The second deep test, a twin to the first, resulted in the first big production of oil which came from Bromide sand at 4175 to 4200 feet. This well was completed at 4210 feet for 945 barrels in four hours and 55 minutes, restricted through chokes.

Acreage included in the Carter transaction was as follows: SE¼ NE¼ and N½ SE¼ SE¼ 25-2n-6e; E½ SW¼ and SE¼ 30-2n-7e; NE¼ NE¼ 31-2n-7e; NW¼ SW¼ 33-2n-7e; N½ SW¼ 28-2n-7e; and the N½ NW 33-2n-7e. In the latter tract only three quarters of the working interest were involved, the remaining one quarter interest having been previously sold to Skelly Oil Company.

That Carter will get under way immediately in the development of its newly acquired acreage was indicated by the report of two tentative locations: Craddock 2, SE SE NE 25-2n-6e, a southeast diagonal offset to Craddock 1, a deep sand well which was included in the sale; and D. Hardin 1, SE SW NW 30-2n-7e.

Langston Pool Gauge Shows Well Holding Up

Guthrie, Oklahoma.—Check of the Langston pool nine miles northeast of here in northeastern Logan County shows the pool to have a flowing capacity of approximately 380 barrels daily. The discovery well, Amerada Petroleum Corporation and Stanolind Oil & Gas Company's Fouts 1, CNW NW NE 14-17n-1w, was completed April 18, 1934 flowing natural at the rate of 225 barrels daily from Wilcox sand topped at 5097 feet. On a recent gauge it produced 201 barrels natural flowing through 2½-inch tubing. This well was drilled to 5246 feet in second Wilcox sand, had a hole full of water and plugged back to 5193 feet. Before completion it was shot wtih 140 quarts of nitro between 5099 and 5193 feet.

J. C. Shaffer Incorporated et al's Dobson 1, CSW SW SE 11-17n-1w, north offset to the discovery well, is now pumping at an average rate of 89 barrels of oil and 12 barrels of water from Wilcox sand logged between 5104 and 5124 feet. It was not drilled to Second Wilcox. The Texas Company's Smith 1, CNE NE NW 14-17n-1w, west offset to the discovery well, on a recent gauge flowed 90 barrels in 24 hours thorugh 2½-inch tubing against 300 pounds back pressure. It is producing from Wilcox sand at 5107 to 5120 feet and green shale and sandy limestone at 5120 to 5130 feet. The lower portion of the open hole appears to be second Wilcox sand but it has not been so reported by the operating company.

Buffalo, Oklahoma.—Sinclair Prairie Oil Company's Neff 1, CNW NW SE 21-26n-24w, wildcat test 11 miles southwest of here in southwestern Harper County, set nine-inch casing at 5203 feet and drilled to 5470 feet. Bailed down to 3000 feet below the derrick floor it showed water and was testing for shut off. This test is two miles southwest of the same operator's Howell 1 which several years ago was drilled to 8583 feet and plugged back to about 5400 feet where it made a gas well.

Important Wildcat Test Starts in Oklahoma County

Oklahoma City.—Location was staked during the week for Bullard 1, C SW SW SW 13-13n-2w, 2½ miles east of the town of Witcher and 11 miles northeast of the Oklahoma City pool, the nearest production. The announcement was made by Eugene Jordan, Oklahoma City attorney; J. C. Shaffer, drilling contractor and producer of Oklahoma City; and L. E. Cooper, Tulsa. The block of about 2000 acres has been assembled during the past four months, each of those interested having purchased leases and royalty separately and combining to complete the block. Clearing the location and laying of water and gas lines were due to get under way late in the week and tools probably will be on location within 10 days.

According to rumors a second important wildcat test is slated to start at an early date in Oklahoma County. Although definite location has not been announced it is believed the test will be located in SW SW 2-14n-3w, approximately four miles northeast of the Edmond pool in the northwestern portion of the county. W. O. Shock et al have a considerable amount of acreage in this area along with several major companies, and it is understood Gypsy Oil Company will have an interest in the test.

Discontinue Taking Oklahoma City Potential

Oklahoma City.—As a result of the granting of supersedeas without bond to Indian Territory Illuminating Oil Company et al, contesting an Oklahoma Corporation Commission order regarding the taking of potential gauges in the Wilcox zone of the Oklahoma City pool, the gauging of that zone has been discontinued until some agreement can be reached among the operators involved.

The order in question granted option to take actual potential gauges or take a decline of 50 percent below the previous potential. Indian Territory Illuminating Oil Company, Delton Oil Corporation and Larkins and Warr contend that option to take decline below previous potentials should not be based on less than 65 percent. Through the proration department an effort is being made to bring about an agreement which will be satisfactory to the corporation commission. Several operators are said to be willing to set the decline at 60 percent as a compromise.

At the time potential gauging was discontinued on September 30, 1934, 154 wells had been gauged for potential and owners of 234 wells had elected to take the 50 percent decline. The former group had a combined new potential of 448,942.72 barrels daily compared to 608,723.81 barrels on the previous determination, a decline of 26.25 percent. Wells taking the 50 percent decline have a combined potential of 431,764.98 barrels, making a grand total of 388 wells with combined potential of 880,707.70 barrels, an overall decline of 40.18 percent. Forty wells in the group showed water ranging from a trace to 67.7 percent.

Edmond Pool May Be Traversed by Fault

Edmond, Okla.—Marathon Oil Company is drilling below 6000 feet in Keefer 1, C NW NW NW 5-13n-3w, a test which should be the fourth producer in the new Edmond pool, four miles west of here in northwestern Oklahoma County. As was the case with the Crescent pool of western Logan County, a structure also located on or related to the Nemaha Granite Ridge, the Edmond structure is furnishing one of the most interesting geologic problems of the past several years. The discovery well, Mid-Kansas Oil & Gas Company's (now Marathon Oil Company) Messer 1, C SW SW SW 32-14n-3w, found top of the Checkerboard lime at 5410 feet and top of the Wilcox sand 6665 feet, an interval of 1255 feet. The same operator's Dahl 1, C SE SE SE 31-14n-3w, west offset to the discovery well, found top of the Wilcox sand at 6385 feet, or 284 feet structurally higher than in the discovery well. There was, however, an interval of only 1035 feet between top of the Checkerboard lime and top of the Wilcox sand, indicating that 220 feet of the section has been cut out. Stanolind Oil & Gas Company and Amerada Petroleum Corporation's Suenram 1, C NE NE NE 6-13n-3w, found top of the Wilcox sand at 6588 feet, 80 feet higher than in the discovery well but 204 feet lower than in Dahl 1. Interval between Checkerboard lime and top of the Wilcox sand in Suenram 1 was 1245 feet or approximately the same as that in the discovery well. Applying the Dahl interval Keefer 1 should have top of the Wilcox at 6415 feet and applying the Messer interval it should have top of the Wilcox at 6635 feet.

Some geologists are of the opinion the structural difference between the discovery well and its west offset is due to a sharp east dip while others believe a fault exists between the two wells. One interpretation places the discovery well, the Suenram and the Keefer, which is now drilling, on the downthrow side of a fault and the Dahl well on the upthrow side. This interpretation is accepted by a few geologists as being the more logical.

Marathon Oil Company (Mid-Kansas Oil & Gas Company) announced location for Dahl 2, C NE NW SE 31-14n-3w, three locations north and two west of the same operator's Dahl 1. It is a south offset to Mid-Continent Petroleum Corporation's Young 1, C SE SW NW 31-14n-3w, which was spudded during the week. Other activities in the area include Charles E. Carter et al's Suenram 1, NEc 7-13n-3w, and four locations by Gulf Petroleum Company. According to reports the latter company has dug cellar and pits at one location and now is drilling a water well. The four locations as follows are on 2½-acre centers, a plan which if followed to completion will force Marathon Oil Company to drill eight offsets on one lease: Lindsay 1, NE NE SW NW; Lindsay 2, NE SE SW NW, Lindsay 3, NE NW SW NW; and Lindsay 4, NE SW SW NW, all in 6-13n-3w.

Crescent, Oklahoma.—Eason Oil Company's Katschor 1-2, CNW NE SW 34-17n-4w, in the southern portion of the Crescent pool of western Logan County, was due to be the next completion in that area. Late reports showed it drilling below 6265 feet with a small showing of oil and gas from Simpson dolomite. Simpson dense was topped at 6195 feet. On the south edge of production the same operator's Herron 1, CNL NE NE 4-16n-4w, was bottomed at 6232 feet in Viola lime and still trying to recover drill pipe.

Gypsy Oil Company's Manning 1, C NW NW 3-17n-4w, wildcat test five miles north of production in the Crescent pool, based the first Wilcox sand at 6267 feet, topped second Wilcox at 6309 feet and cored from 6311 to 6363 feet, recovering salty tasting formation with nothing showing. It was drilling ahead below 6366 feet but probably will be stopped at top of siliceous lime if nothing of importance is found there.

Burton Area Locations

Hutchinson, Kansas. — Two locations were staked during the week in the Burton area northeastern Reno County, placing that area farther in the lead which it has held for the past several months. The Texas Company made location for No. 1, C SW NW 15-24s-4w; and Sinclair Prairie Oil Company was getting under way at Carmichael 1, C NE NW of the same section. The former is a 40-acre south offset and the latter a 40-acre east offset to Hartman et al's Stone 1, C NW NW 15-24s-4w, recently completed for 523 barrels of oil and 40 barrels of water from lime at 3308 to 3389 feet.

In the Burton pool Sinclair Prairie Oil Company's C. Base 1, C NW NE 36-23s-4w, produced at the rate of 243 barrels of oil and 185 barrels of water daily on potential gauge. It is producing from chat, one of the four productive horizons in the area.

Barnsdall Oil Company's Sabin 2-C, C

NE NE SW 11-23s-4w, was waiting on cement to set on 12½-inch surface casing set at 581 feet and its C. Baughman 2, C SE NE NE 34-23s-4w, was drilling below 700 feet.

In the Haury area of northeastern Reno County, Lloyd, Frost and Study and Turner were drilling below 650 feet in White 3, CNW SE SE 2-23s-4w and its southwest diagonal offset, Shell Petroleum Corporation's Ratzlaff 1, CSE SW SE 2-23s-4w, was bottomed at 3609 feet and had 2300 feet of oil in the hole from Hunton lime topped at 3607 feet. On a preliminary test it swabbed at the rate of 12 barrels per hour and was slated to go deeper and receive acid treatment before being completed. Olson Oil Company's Downie 1, CSE SW NE 14-23s-4w, was drilling in lime at 2373 feet.

Argonia, Kansas.—Lew Wentz et al's Bellsley 1, CNW N WSW 5-33s-4w, wildcat test four miles south of here in western Sumner County, went out of Mississippi lime at 4570 feet, topped the Simpson formation at 4655 feet and cored a stain of oil from 4660 to 4661 feet. Coring ahead operators had hard sand to 4673 feet with salt in the last two feet recovered. It will be drilled to the contract depth of 4700 feet and if no further showing are encountered will be abandoned at that depth.

Russell, Kansas—The new Palmer pool was due for a further increase in its potential as Tom Palmer prepared to complete Barrell 3, C SE SE SE 21-13s-14w. Six-inch casing was set at 3268 feet and siliceous lime penetrated from 3276 to 3280 feet at which depth the hole was filling at the rate of 400 feet an hour. The test is in a pool discovered by Tom Palmer early in the year.

Wichita, Kansas.—Trees Oil Company et al's McMinn 1, C NW SW NE 36-26s-1e, a wildcat test two miles northeast of the Wichita city limits, topped Viola lime at 3362 feet, logged Wilcox sand from 3378 to 3430 feet and was being abandoned with a hole full of sulphur water.

Kansas New Work Below Expectations

Wichita, Kansas.—Observers were having difficulty in finding an explanation for the recent decline in Kansas activity since it had been expected that with plenty of water from rains of the past six weeks development would increase at a rapid rate. During most of the year major companies have been studying the western portion of the state intensively and it is seldom that less than 15 geophysical parties have been active. As a result of this widespread scientific activity leasing and royalty plays have been given impetus in many areas. During the past week development underwent a further decline when only 13 first reports were made to offset 19 completions.

Of the 19 completions shown below 12 were oil wells with combined initial production of 7576 barrels, one was a dry gas well with initial volume of 50,000 cubic feet and six were dry holes, a total of 40,885 feet of drilling being involved. The Burrton area of northeastern Reno County stood far ahead of the remainder of the state with five wells yielding 6513 barrels initially. Two of these were old wells drilled deeper.

Company, Well and Location	Init. Prod. Bbls.	Depth
BUTLER COUNTY—		
Flint Hills Oil & Gas, Martin 7, ne ne ne 27-28s-4e	50,000	1497
CHASE COUNTY—		
Paulhamus, Leady 1, se sw nw 25-22s-9e	*	1330
Polhamus, Skelly & Selby, Leady 2, nw nw se 25-22s-9e	30	2546
ELK COUNTY—		
Clay Petroleum, Smith 1, csw ne 21-29s-9e	*	2825
Osborn, Morss 1, sw sw ne 27-29s-10e	*	1500
Brinegar Bros & Haddox, Fleak 5, ne ne sw 21-30s-11e	5	1255
GREENWOOD COUNTY—		
G. Southern, Hull 34, sw ne ne ne 10-26s-8e	10	2484
HARVEY COUNTY—		
Hollow, Swafford 1, nw ne nw 8-22s-1w	144	3356
McPHERSON COUNTY—		
Palmer, Moddeling 1, ne ne nw 8-21s-1w (owdd)	*	3596
RENO COUNTY—		
Barnsdall Oil Co, Sabine 1-A, se se nw 11-23s-4w (owdd)	1712	3610½
Sabine "B" 5, nw ne ne 11-23s-4w	1718	3610
Derby Oil Co, Ackley 1, ne nw se 14-23s-4w (owdd)	2294	3601½
Olson Oil Co & Shell Petroleum Corp, E. Krehbiel 3, cnw ne 26-23s-4w	266	3367
Hartman et al, Stone 1, cnw nw 15-24s-4w	523	3389
RICE COUNTY—		
Empire Oil & Refining Co, Miller 1, se ne se 13-20s-10w	779	3345½
RUSSELL COUNTY—		
Stanolind Oil & Gas Co, Oswald 3, nw ne nw 8-12s-15w (owdd)	45	3155
I.T.I.O., Driscoll 1, ne ne sw 21-13s-14w	*	3383
SEDGWICK COUNTY—		
L. Spencer, Jacobs 1, se se se 22-25s-1w	50	2721
Gypsy Oil Co, Tammary 1, nw nw ne 4-29s-1w	*	3952

*Failures; †Junked; ¶Million cu. ft. gas.

Kingman, Kansas.—McBride et al were drilling below 4025 feet in Mississippi lime and carrying 1000 feet of water in Wooldridge 1, C NW NW NE 16-27s-7w, 2½ miles northeast of here in north-central Kingman County. Top of the chat horizon was reported at 3873 feet.

Texas Commission Plans Changes in Its Rules

Austin, Texas.—Revisions in Rules 9 and 36 of the general rules for the operation of pipe lines in Texas, as promulgated by the Texas Railroad Commission, may be revised following a hearing which has been set tentatively for November 5.

Rule 9 involves the allowances for deductions for strappage, shrinkage in transit, and variations in temperature. This rule allows deductions totaling 3.5 percent in some areas, which is too high in the opinion of commission officials in charge of pipe line regulation.

The rule was revised by the commission following hearings held last year, and the deductions allowed were reduced by about one half of one percent. The pipe line companies protested against the change, pointing out that the expense of preparing new tank tables alone would amount to $100,000.

Olin Culberson, in charge of pipe line regulation for the commission, declared that the present allowances are too high, and that they tend to throw thousands of barrels of distress oil into the market.

Some of the pipe line companies have reported as much as a million barrels per year derived from this source.

Rule 36 is the rule providing that a pipe line company must have a permit from the commission before receiving oil. It also includes a provision allowing the commission to revoke or refuse renewal of permits if a line has been operated in violation of rules of the commission, or the conservation statutes.

Means of strengthening this rule to enable the commission to use it effectively in denying permits to companies charged with running hot oil will be brought out at the hearing.

The regulation came to the attention of the operators recently when four East Texas pipe line companies were denied renewals of their permits for alleged violations.

Culberson declared that there were instances where lines in other sections of the state have also been charged with violations, but have not been brought to the notice of the industry publicly.

D. W. BOYLAN, vice president of General Paint Corporation, has been transferred from the West Coast to Tulsa where he is now in charge of the eastern division. Dave Boylan, formerly in the eastern division with headquarters in Tulsa, has been transferred to Seattle, Washington, where he will act as manager of the northwestern division. W. D. "Bill" Tuebner has been elevated to the position of sales manager of the eastern division and remains in Tulsa where he has been assistant sales manager of the division.

Texas Monthly Proration Hearing Set October 29

Austin, Texas.—The Texas Railroad Commission has announced that a statewide proration hearing will be held in Austin on October 29. This is the regular monthly hearing at which evidence is presented upon which is based commission orders fixing allowables for all Texas fields.

Purchasers of Texas crude will be required to file before the hearing, nominations indicating the amount of crude they expect to purchase during each month of the next quarter. The commission uses this method to obtain its own information on the market demand for crude oil. These figures are carefully compared with the consumer demand as calculated by the Bureau of Mines.

Plans for calling for nominations originally provided for the listing of oil according to gravity. Commissioner Thompson, who announced this plan, intimated that oil from one field might be diverted into markets now held by other fields.

"If they will tell us what kind of oil they need, we will find it for them," he declared. The plan, however, was abandoned before the notice calling for nominations was issued.

East Texas

One of the most important subjects to be presented at the hearing will be the revision of the method of taking potentials in the East Texas field.

Tests made now allow runs for two hours with key wells flowing wide open through the casing. Key wells are selected and tested since special equipment is required and adequate storage facilities must be furnished for the test oil produced. Commission petroleum engineers, under the direction of Gordon Griffin, have been making a series of open-flow tests through the tubing. These tests have been made during the past two months, and at the last statewide hearing, the results of some of them were presented. Griffin declared that the data obtained indicated that either series of tests was equally indicative. However, he recommended that no change in the method of testing be made for at least 30 days, giving operators opportunity to make thorough checks and offer any suggestions that they may have.

Increased Allowables Asked

North Texas operators have advised the commission that they are having much difficulty in producing their wells within the allowable of 56,500 barrels per day. There are some 16,000 wells in the district. The great majority are marginal wells producing 10 barrels of oil per day or less. The commission is prohibited under provisions of the marginal well statute, from reducing the per-well allowance below 10 barrels per day. As a result of this condition, most of the district allowable must be assigned to marginal wells, leaving little to be distributed among the flush producers. The seriousness of the problem may be realized when it is recalled that more than 1000 new wells have been completed this year in that area.

Rabb Ridge

An increase of 100 percent in the allowable for the Rabb Ridge field in Fort Bend County has been asked by royalty owners, Cullen and West of Houston. The allowable fixed by the current order is 9000 barrels per day. The royalty owners presented a petition to the commission last week, pointing out that the field was capable of producing the additional amount of oil without physical waste. They urged that the oil could be substituted for Columbian crude now being imported for the Humble refinery at Baytown, since the gravity, about 20, is nearly the same, and the field is much closer to the refinery than the present source of production. The case was taken under advisement by the commission, but action will probably be delayed until the hearing is held.

Market Increase

At a recent hearing, A. J. Johnson, Dallas oil broker, advised the commission that he was prepared to purchase 40,000,000 barrels of East Texas crude, over and above the allowable production which the field has now. Firmness of this demand was seriously questioned by operators present, especially representatives of the major companies. Johnson stated that all of the oil was for export, and stated that it would go to Japan, China, Great Britain and Germany. Commissioner Thompson said last week that this demand was "firming up," and that $1,000,000 cash, to be used as a revolving fund in purchasing the crude, would be posted in a bank at Port Arthur, Texas, according to advices which the commission has received. The commission was asked to allow the additional production, but has never taken any action on this question.

Hearings on several small fields which have been held during the last month have eliminated the necessity for most of the detailed testimony usually offered at the general hearings.

Thompson Sees Improvement In Enforcement Activities

Austin, Texas.—Materially improved conditions in controlling hot oil movements from the East Texas field were predicted by Commissioner Ernest O. Thompson upon his return to Austin last week from conferences with federal officials.

Thompson pointed to the agreement for cooperative enforcement by state and federal authorities as indicative of the end of federal control measures offered at the last session of congress.

"We have previously offered them our records and volunteered to cooperate with them," Thompson said, "but this is the first time that they have seen fit to take advantage of the offer.

"With the railroad commission checking intra-state and the federal authorities observing interstate shipments, there should be a complete enforcement of the production regulations," he declared.

"The federal agencies have all necessary powers under Section 9-C of the N.R.A. provisions of this statute, if enforced, can prevent the movement interstate of any oil or oil products that have resulted from production in excess of state allocations," he said.

Thompson spent several days in the East Texas field with the federal agents, working out plans for improved enforcement. He refused to reveal the federal campaign plans, but declared that they were ready "to shoot the works."

The commissioner went to the field directly from Washington where he had conferred with oil administrative executives.

The suggestion of Governor-elect E. W. Marland of Oklahoma for a state pact to regulate oil production was also noted by Thompson. He pointed out that this plan varied widely from the bill offered by Marland in Congress, which would have created a federal oil dictator, and indicates that Marland has materially altered his views.

Texas Tax Figures Show Output Above Allowable

Austin, Texas. — State Comptroller George H. Sheppard has announced that gross production taxes were paid on 32,801,826 barrels of crude oil produced during August. The daily allowable for the month as fixed by the Texas Railroad Commission was 964,159 barrels average. The comptroller's report shows a daily average of 1,058,123 barrels per day.

During the year ending August 31, the comptroller corrected the gross production tax on 364,721,615 barrels of crude. Commission allowables over the same period permitted the production of only 354,977,392 barrels, a difference of 9,774,223 barrels.

The daily average allowable over the period was 969,527 barrels, while tax was paid on an average of 996,220 barrels per day, a difference of 26,693 barrels per day.

This report covers the first year that the current gross production tax law was in effect. This law provides for a tax of two cents per barrel on all crude until oil reaches $1; thereafter the tax amounts to two percent of the value of the product.

The tax of one-eighth of one cent per barrel which is diverted to the commission for conservation enforcement, brought in a total of $419,101.50 during the year. The two-cent tax brought $7,478,058.12 into the general revenue fund of the state.

Plans for increasing this tax to three cents a barrel, which are reported to be prepared for the coming special session, would mean an increase of $3,739,029 for the state, or a total of $11,217,087 which oil companies would have to pay under the tax proposed.

Corpus Christi Tanker Terminal Enlarged

Corpus Christi, Texas.—Erection of two 80,000-barrel steel tanks and a number of small tanks has been started by the General American Tank Storage & Terminal Company, Inc., at its recently acquired tanker terminal here. The new storage facilities will boost the company's total accomodations to about 400,000 barrels. Tanker shipments of refined products manufactured by Corpus Christi Refining Company's local plant and a large volume of crude from Southwest Texas fields is scheduled to be handled by this terminal, which was acquired from Corpus Christi Terminal Company.

East Texas Properties In Good Demand

Tyler, Texas.—An upturn in the trend of property values in the East Texas field is reflected by the sale of Leonard Petroleum Company's one half interest in the R. Corbin 20-acre lease, H. Edwards Survey, with two wells, to J. A. Woods and Tevis Morrow, Dallas operators, for a consideration of $62,000. Permit has been granted for the drilling of a third well on the tract. R. K. Vierson, Okmulgee, Oklahoma, retains the other 50 percent interest. The two wells have a combined allowable of 65.52 barrels daily. The lease is located several miles northeast of Gladewater.

Comparatively few properties having good sand conditions and isolated from water are offered for sale. Prospective buyers are numerous, and are bidding up prices in the face of reduced allowables.

Shoreline Oil Company, which is controlled by Clint W. Murchison and Dudley S. Golding, Dallas, is reported to have acquired Blackstock Oil Company's W. P. Brightwell 10-acre lease, Robt. E. Winn Survey, northern Rusk County, with four flowing wells. The consideration was not made public.

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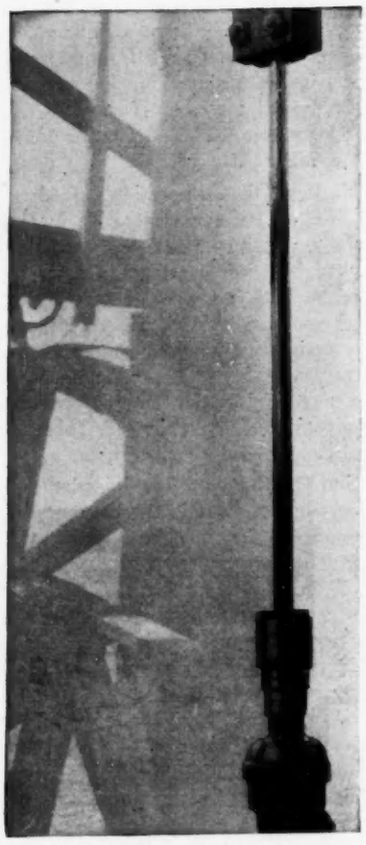

Hundreds of corrosive wells now use Monel Metal polished rods. Note the smooth, uncorroded condition after years of service.

Two Gassers Completed In East Texas South End

Tyler, Texas.—Two gassers on the south end of the structure were included in the 73 completions credited to the East Texas field during the past week. Other exceptions to the routine quota of flowing and pumping wells afforded each week by the field was the completion of a dry hole on apparently proven location and two junked tests.

Magnolia Petroleum Company's B. F. Spence 1, NWc of 77.74-acre tract, Levi M. Sparks Survey, tested 10,000,000 cubic feet of wet gas from sand at 3650-3660 feet, with the hole bottomed in shale at 3662 feet, or 3290 feet below sea level. Eastern Texas Petroleum Company added the other gas well for the South Joiner area in completing S. E. Arnold 1, SWc 16-acre lease and a short distance north of the above gasser, estimated at 4,000,000 cubic feet daily after shot of 40 quarts of nitro in sand at 3624-3668 feet. It was drilled into salt water at 3675 feet and plugged back.

Tight sand conditions were attributed to the failure of Humble Oil & Refining Company's W. C. Mackey 19, NEc 198½-acre lease, H. F. Rogers Survey. It is located in north Gregg County near the east edge of production, and supposedly on a proved location. Georgetown lime was logged at 3648-3666 feet, or 3363 feet below sea level.

Margay Oil Corporation's J. A. Cain 1, SEc of 105-acre lease, T. J. McKey Survey, Upshur County, experienced a junked hole while trying to complete in sand at 3628 feet, or 3345 feet below sea level, and has skidded rig. This project was trying for a minor extension to the structurally low oil producing area on the north end of the field. Marathon Oil Company's M. A. Price 18, Joiner area, also experienced a junked hole.

Sun Oil Company has joined the ranks of producing units in the structurally low section of the field in Upshur County through the completion of E. F. Johnson 1, SWc of 80-acre lease, C. H. Cooper Survey. This well gauged 20 barrels of oil per hour under choke at 3630 feet, or 3322 feet below sea level. Sun Oil Company subleased this tract to C. H. Lyons et al, who drilled a noncommercial pumper making salt water with oil in the northwest corner of the tract early this year. This failure and several others on nearby leases gave rise for the belief that the north sector was definitely segregated from the field proper. However, such a theory has been refuted by later development linking the structurally low area.

T. D. Humphrey et al's Ed. Johnson 2, a southeast diagonal offset to Sun Oil Company's Johnson 1, tested salt water in sand at 3650 feet, or 3339 feet below sea level, and has been plugged back to 3638 feet for another production test.

Eastern Texas Petroleum Company, largest owner of production in the extreme north end of the field, placed another lease on production through completion of W. A. Ray 1-B, located at center of 11-acre lease, C. H. Cooper Survey. This well gauged 20 barrels of oil on 15-minute open tubing test from sand at 3604-3607 feet, with the hole bottomed at a sub-sea depth of 3334 feet. Roger Lacy et al completed a small producer on the Ray land, flowing 40 barrels of oil per hour by heads from sand at 3610-3616 feet, or 3346 feet below sea level.

Detailed list of completions in the East Texas field during the past week follows:

Company, Well and Location	Init. Prod. Bbls.	Depth
Joiner Area—		
Atlantic O. P. Co., C. C. Giles 4-B, (11-ac)	8500	3733
B. G. Byars et al, L. A. Jackson 2	9000	3818
R. H. Dearing & Sons, Pinkston 1	3000	3565
Eastern Texas Pet. Co., S. E. Arnold 1 (16-ac)	¶4	3672
F. W. Fischer et al, Wilson 1	7600	3739
Gulf Prod. Co., H. Johnson 5 (101-ac)	8300	3773
Humble, J. H. Arnold 10 (62½-ac)	9000	3792
A. D. Blackwell 35-A (325.79-ac)	10,000	3652
M. E. Minor 11 (123-ac)	7000	3689
S. A. Plowman 32-B (228¼-ac)	10,500	3707
Magnolia Pet. Co., B. F. Spence 1 (77.74-ac)	¶10	3662
Manahan Oil Co., S. S. Cook 5 (25-ac)	9800	3750
Marathon Oil Co., M. A. Price 18	†	3451
Octo Oil Corp., F. J. Cox-Leonard 3-B (10-ac)	6800	3743
Shell Pet. Corp., H. Brooks-Lion 11-A (174.69-ac)	3000	3746
Sinclair Prairie, Dora Wright 17 (152.1-ac)	9700	3771
Stanolind O&G Co., W. H. McCord 2 (31.89-ac)	180	3622
W. Wooley 2 (58-ac)	160	3581
Trees Oil Corp., Alford 1	1000	3698
Deason 3 (6-ac)	3600	3688
Wainwright-West Oils, Ltd., Irion 2	7200	3748
Kilgore Area—		
Adams & Lyle, L. Howard 10 (47.7-ac)	6000	3635
American-Liberty Oil Co., Sabine River 33, Tr 5	9600	3551
Arkansas Fuel Oil Co., G. Donaldson 6 (40.4-ac)	10,000	3589
Hughey-Ross 16 (220-ac)	7800	3555
Barnsdall Oil Co., J. Douglass-Shell 9-B (137-ac)	6000	3627
Gulf Prod. Co., S. Hilburn 59-E (274.32-ac)	7000	3554
W. G. Sexton 13 (165.58-ac)	5500	3714
A. Spear 31 (93.92-ac)	7200	3578
R. H. Still 15 (188.38-ac)	3000	3552
Houston Prod. Co., W. P. Brightwell 5 (22-ac)	9700	3600
K. Hughes et al, Adkins 5 (9-ac)	7200	3667
T. D. Humphreys et al, A. Spear 3-B	5800	3571
Magnolia Pet. Co., A. Hicks 16 (99-ac)	9500	3651
F. W. Martin & Co., Elder 2-A	500	3575
Paul L. Miller et al, L. Crim 3-B	2500	3578
T. S. Schroeder et al, King 1	185	3637
Sultana Oil Corp., Sabine River 1-E, Tr. No. 6 (41-ac)	9700	3552
Sabine River 1-G, Tr. No. 6 (41-ac)	9600	3548
The Texas Co., M. T. Cole 30 (145.15-ac)	8000	3550
S. D. Walker 6 (213-ac)	3600	3591
Weaver-Crim Corp., B. B. Peterson 6 (60-ac)	9200	3627
Longview Area		
Arkansas Fuel Oil Co., Adrian-McCrary 9 (65-ac)	11,000	3557
J. C. McKinley 6-B (69.01-ac)	9200	3630
Atchafalaya Oil Corp., Walker-Harris 5 (23-ac)	8000	3573
Atlantic O.P. Co., J. C. Judge 63-A (455-ac)	7000	3525
J. C. Judge 64-A (455-ac)	8200	3541
J. C. Judge 65-A (455-ac)	8300	3533
H. W. Moyers 16 (128-ac)	10,000	3585
Atlantic & J. K. Wadley, T. W. Lee 12 (110-ac)	10,500	3627
Eastern Texas Pet. Co., W. A. Ray 1-B (11-ac)	7000	3607
F-H-E Oil Co., B. C. Christian 13 (87-ac)	8600	3720
Great Plains O&G Co. (E. H. Hughes, Rec.), Christian 4 (24-ac)	8500	3610
Gulf Prod. Co., J. C. Judge 59 (518.3-ac)	8000	3549
Humble O&R Co., A. Carter 13 (90-ac)	7600	3636
G. W. Johnson 14 (102-ac)	5700	3704
W. C. Mackey 19 (198½-ac)	*	3666
I. D. Smith 27 (245.98-ac)	4000	3648
Roger Lacy et al, Ray 1	1000	3616
Lucy Pet. Co., McHaney-Loeb 7 (39.82-ac)	11,500	3582
Magnolia Pet. Co., Scurry Christian 3 (153¾-ac)	9000	3690
D. G. Sparks 5 (52.3-ac)	7200	3681
Margay Oil Corp., J. A. Cain 1 (105-ac)	†	3628
O. G. Murphy, Tr., J. B. Doby 7 (45-ac)	8800	3552
Oil, Inc., J. C. Bumpas-Hoffman 2 (10-ac)	8500	3563
Shell Pet. Corp., A. N. & V. King 16 (160-ac)	7800	3617
Stanolind O&G Co.-Simms Oil Co., J. W. Akin 11 (80-ac)	8500	3624
Sun Oil Co., E. F. Johnson 1 (80-ac)	5000	3630
J. C. McKinley 10 (82.3-ac)	8600	3673
Sutton & Hawkins, J. A. Whittaker 7 (27-ac)	8800	3525
Travis & Wair Oil Co., L. P. League 4 (10-ac)	5700	3601
Yount-Lee Oil Co., Minnie Jones 9 (83.23-ac)	9200	3506
F. K. Lathrop 6-B (63.6-ac)	9000	3563
Miscellaneous		
ANDERSON COUNTY (Cayuga field)—		
Tide Water-Texas Seaboard, V. C. Wortham 2 (100-ac)	3500	4078
VAN ZANDT COUNTY (Van field)—		
Van Zandt Synd., C. S. Coker 1	2	1208
Wildcats		
CHEROKEE COUNTY—		
Zilkey-McCullough & Sinclair Prairie, J. C. Bradford 1	*	5177
HUNT COUNTY—		
G. S. & S. Oil Co., Oscar Popper 1	*	2652
LEON COUNTY—		
Killough & Tucker, G. B. Young 1-A	*	5548
RAINS COUNTY—		
Rio Oil Corp., O. L. J. Easter 1	*	3924

*Failures; †Junked; ¶Million cu. ft. gas.

Two Strikes Indicate Winkler County Trend

San Angelo, Texas.—Two semi-wildcat oil strikes made in Winkler County during the past week in sandy-lime belt paralleling the east flank of the Hendrick field adds weight to the theory previously advanced by geologists that a series of fields will be uncovered across the county in a northwest-southeast trend between the Gulf-O'Brien district and the Scarborough field. Recent developments have stimulated interest in the territory lying between the two areas, which have been on production since 1929 and 1927, respectively. Although wells in the older fields are not spectacular in regard to potential flow, the majority continue to flow under back pressure necessitated by proration restrictions.

Sid Richardson, Fort Worth, and associates, owners of the bulk of the producing acreage in the Scarborough field as now outlined, developed production from M. J. Hill 1, C SW SE Section 18, Block B-11, P.S.L. Survey, near the 3150-foot level. This test is two miles northeast of Skelly Oil Company's S. M. Halley 1, a wildcat producer in the southern part of Winkler County and 4½ miles northwest of the Gulf-O'Brien field. The test on the Hill tract encountered a light flow of gas in the top section of the pay zone, resulting in the loss of a string of tools. A second string of tools has since been lost in the hole, and oil began showing while trying to recover this junk. No estimates are available as to the probable size of the well in its present status.

Skelly Oil Company's Halley 1 began flowing 31.3 gravity oil late in August from main pay zone at 3105-3112 feet, and later gauged 382 barrels under choke in 16½ hours. About 150 feet of cavings accumulated in the hole while awaiting pipe line connections, causing production to drop to less than 10 barrels hourly. The completion of this wildcat has been further delayed by the loss of the cleanout tools, and fishing is now in progress.

The upper part of the Scarborough-Gulf-O'Brien production trend broke into the limelight last week when Sayre Oil Company, Chicago, and associates' J. F. Howe 1, NWc N½ SW Section 12, Block 26, P.S.L. Survey, indicated a natural flow of 500 barrels of oil and 5,000,000 cubic feet of gas, according to estimates, from a series of oil and gas zones in drilling to 2875 feet, or nine feet below sea level. It is 3½ miles south of nearest production on Magnolia Petroleum Company's J. B. Walton 8000-acre leasehold, bordering the Scarborough field on the south, and 2½ miles northeast of nearest production in the Hendrick field, which produces from porous limestone. A six-barrel producer held by Wahlenmaier Petroleum Corporation on the Fred Leck tract two miles west by north of Howe 1 is several hundred feet lower on structure.

Preliminary showing made by Sayre Oil Company's wildcat, which is awaiting tankage and pipe line connection before attempting an accurate production gauge, will lead to the drilling of a number of tests in the immediate area. Heavy gas production was logged at 2608-2680 feet, necessitating the change to rotary equipment. The well began making oil near the 2800-foot level, with increases at 2840-62 feet and 2873-75 feet.

Tests are being started directly east of the Hendrick field and in the sandy-lime belt by Joe C. Maxwell, Fort Worth, and also by Fox, Butler and T. J. Jefferies, while Sid Richardson et al are preparing to comply with a contract to drill on Section 1, Block B-3, P.S.L. Survey, made recently in acquiring leases from Pure Oil Company and others. This project is southeast of the Scarborough field, and is slated to go to 4500 feet.

Ector County

An estimated flow of 25,000,000 cubic feet of dry gas developed by the northwestern Ector County wildcat of Landreth Production Corporation et al on the John Scharbauer ranch since drilling by tools to 4085 feet has successfully withstood efforts to lubricate. Gas topped at 4064 feet resulted in the tools being lodged below the seven-inch casing, which was cemented at 3725 feet.

Delaware lime horizon is the projected goal of a deep wildcat test to be drilled in northeastern Reeves County by Herbert Oil Company, Fort Worth. Location has been made for E. M. Williams 1, near center of Section 17, Block 6, H&GN Ry. Survey, 12 miles east by south of Pecos and southeast of a small pool in western Ward County.

Hard limestone and chert formation logged by Gulf Production Company's J. T. McElroy 103, Upton County, has failed to yield an increase in oil and gas while drilling below 10,865 feet. However, the well continues to produce a small volume of high gravity oil with rotary returns from the 10,800-foot level. Fresh water is used for circulation.

Another shallow oil pool for Jones County has been established by John Byram, Abilene, Texas, and associates' Percy Jones 1, near SWc NW Section 5, Block 15, T&P Ry. Survey, estimated at 75 barrels of 39 gravity oil daily from sand at 1930-1931 feet. This wildcat is several miles southwest of the Higgs pool, which produces from a shallower sand. Casing is to be lowered to the top of the sand in the new producer, and the hole deepened.

Pumper Opens New Field In Hutchinson County

Pampa, Texas. — The Texas Panhandle placed on record a new oil pool last week when Humble Oil & Refining Company's S. J. Logan 1, northwestern Hutchinson County, proved capable of making a commercial pumper from saturated dolomite at 3217-3219 feet. This test is the first attempt for production in Hutchinson County by the company, as no effort was made to participate in the development of the Borger field, a market disturber in its flush stage. Logan 1 is located 2314 feet east and 990 feet north of the southwest corner of the A. B. Pedigo Survey No. 1, or about 7½ miles north of nearest production in the Stinnett area. It is near the center of a 11,000-acre block held under lease by the company, and in a sparsely explored section of the county.

Lacking sufficient gas to make a flowing well, Logan 1 filled 800 feet with oil, testing 34.6 gravity, after drilling into the saturated lime with cable tools. Rotary equipment was used in drilling to 2804 feet, where 8¼-inch pipe was cemented in the big lime, which was logged at 2420 feet, with an elevation of 3314 feet. The hole is bottomed at 95 feet above sea level, or a safe distance above the expected water level. The oil horizon will likely be treated with acid, as the limestone in Hutchinson County responds favorably to the injection of chemical solutions. Two 500-barrel lease tanks have been ordered erected at the well, since it is isolated from pipe line facilities, while the crew is installing rods and tubing to pump.

Semi-wildcat territory in northwestern Collingsworth County yielded a dry gasser when G. P. Milton et al's A. B. Franks 1, SWc NE Section 8, Block 23, H&GN Ry. Survey, tested 10,000,000 cubic feet of gas in top section of granite wash formation entered at 2515 feet, or eight feet above sea level. Salt water was encountered at 2520-2525 feet. Operations were suspended at the latter depth, but plans are to plug back to complete as a gas well. Others associated with Milton in the drilling of this test includes G. E. Mayer, J. E. Allison and H. Avehod, all of Amarillo.

Phillips Petroleum Company et al's

Jas. C. Wilson 2, deep test in northeastern Moore County, has shut down to cement 9⅝-inch pipe in lime at 6689 feet, with a total depth of 6696 feet. This is the first deep test for the district. The cost is being shared by all lease owners in the general area.

An aggregate of 3915 barrels of new production was added by the district last week through completion of 10 wells. A dry gas well in Hutchinson County was rated at 22,800,000 cubic feet daily. There were also two dry holes and a junked hole. Both dry holes were on producing leases. Eben D. Warner et al's L. H. Webb-Skelly 2, C NW NW Section 42, Block 25, H&GN Survey, encountered an erratic condition in eastern Gray County, and failed to produce oil or gas in commercial quantities after drilling to 3040 feet. Humble Oil & Refining Company's J. P. Koons 4, SWc E½ NW Section 43, Block 24, H&GN Survey, sustained a similar fate in drilling to 2406 feet. The latter is in the west extension of the Shamrock field, Wheeler County.

Completions in the Texas Panhandle during the past week follow:

Company, Well and Location	Init. Prod. Bbls.	Depth
CARSON COUNTY—		
Stanolind, L. C. McConnell 2	†	3065
GRAY COUNTY—		
Denworth Oil Co., L. H. Webb 3, Tr. No. 1	265	2688
I.T.I.O., A. Smith 6	675	3268
Niapa Oil Corp., G. Cole-Tidal 1	50	3321
Eben D. Warner et al, L. H. Webb-Skelly 2	*	3040
Wilcox O&G Co., Combs-Worley 31	85	2934
HUTCHINSON COUNTY—		
J. M. Huber Pet. Co., S. B. Burnett 2-A	¶22.8	2520
Means & Risher, E. Cooper 1	55	3237
Phillips Pet. Co., D. Jordan 3	280	3032
Wm. Yake 3	215	2922
WHEELER COUNTY—		
El Bar Corp., J. M. Noel 4	185	2441
Hanlon-Buchanan-Smith Bros., Harnett 2-A	¶22.8	2520
Humble, J. P. Koons 4	*	2406
Shell, W. B. Bush 3	780	2475

*Failures; †Junked; ¶Million cu. ft. gas.

Wichita Falls, Texas.—Completions in North Texas continue at a low level, with an aggregate of 22 during the past week. Exploration work was forced into a slump late in the summer because of absence of water for drilling rigs in many of the popular areas, and since this handicap has been overcome operators are reluctant to resume their former stride in drilling due to a shrinkage in market outlet for crude production. This decreased crude demand led to a reduction in allowables of all prorated wells in the district effective October 1.

An equal number of producers and failures were recorded last week. There were 10 oil wells, having a combined initial rating of 2853 barrels, and a shallow gasser in Throckmorton County. The volume of new production was largely confined to Archer and Wichita Counties. The shallow lime belt in southern Archer County yielded the largest well when F. P. Cullum and Sinclair Prairie Oil Company's Falls County-Scranton 12, Block 17, responded to acid treatment at 1110 feet with a steady flow of 80 barrels of oil per hour.

Detailed list of completions in North Texas during the past week follows:

Company, Well and Location	Init. Prod. Bbls.	Depth
ARCHER COUNTY—		
Lester T. Burns et al, T. B. Wilson 1, sec 12	*	1700
R. A. Clampitt et al, Benson-Richards 1, sec 1397	*	957
Continental & Cullum, Falls County 16	50	1120
Jas. N. Crofton et al, Logan 5	75	1170
F. P. Cullum & Sinclair Prairie, Falls-Scranton 12, blk 17	1920	1110
Fain-McGaha Oil Corp., W. P. Ferguson 22-C, sec 2	13	656
Garretson & Clement, R. O. Andrews 1, sec 1805	*	955
Perkins-Cullum Oil Co., Falls 12-B, blk 21	175	1128
Petroleum Prod. Co., W. P. Harmonson 4	120	973
J. I. Staley et al, M. P. Andrews 2	*	1025
The Texas Co., R. O. Andrews 1	*	1010
CLAY COUNTY—		
The Texas Co., R. D. Scott 1, blk 3	*	1417
JACK COUNTY—		
Vern Clopton et al, S. M. Gay 1, sec 1	*	602
Ida Volk Oil & Gas Co., W. Brumbelew 1	*	500
THROCKMORTON COUNTY—		
Reliance Oil & Roy. Co., Lee Tuton 2	¶¾	790
WICHITA COUNTY—		
King Royalty Co., Waggoner 1-I	400	1974
Pet. Prod. Co., Allen-Kemp 44, sec 28	15	463
M. J. Sullivan et al, R. M. Waggoner 1, blk 11	*	1254
E. P. Waggoner et al, Waggoner 3-C, sec 148	65	1555
YOUNG COUNTY—		
J. E. Elliott et al, E. R. Prideaux 1	*	601
Bert N. Honea et al, Fee 4, sec 1492	20	918
Wooten & Reed, E. C. Reed 2, sec 1911	*	570

*Failures; †Junked; ¶Million cu. ft. gas.

Brown County Wildcat Producer Being Completed

Brownwood, Texas.—Brown County has a wildcat oil producer in process of completion about seven miles northeast of Brownwood as result of Steve C. Herring et al's L. D. Scott 1, near center of east line of Block 16, Wm. K. Dalton Survey, registering a flow of about 50 barrels daily after shot of 60 quarts of nitro in saturated lime at 1885-1904 feet. This wildcat was drilled to 1950 feet, and plugged back before given a shot. Herring, Brownwood operator, and associates, previously drilled a 1930-foot test in the southeast corner of Block 16, but the hole was junked while testing the lime horizon.

Flowing Wells Predominant In West Texas Completions

San Angelo, Texas.—Flowing production was developed from all but one of the seven completions in West Texas during the past week, with five fields participating. These wells accounted for an aggregate of 56,995 arrels of new production. The single pumper was completed in the Howard-Glasscock County district, where all wells are on the pump.

The south portion of the North Cowden field, Ector County, came through with another large producer last week when Continental Oil Company's T. P. Land Trust 2-A, SEc NE Section 3, Block 43, T-1-S, flowed 50 barrels hourly after shot of 200 quarts of nitro in lime at 4150-4255 feet. This new producer was given a potential of 1201 barrels daily on proration test.

The Yates field contributed the largest well for the period when Pecos Production Company's J. H. Tyler-State 1, located in SEc of 24.41-acre vacancy tract, Section 104, T. C. Ry. Survey, earned a potential rating of 53,628 barrels daily from saturated lime at 1160-1344 feet. It is situated in the heart of the prolific section of the field, and received a proration allowable of 690 barrels daily. Marathon Oil Company has started two offsets on its I. G. Yates "G" lease.

Company, Well and Location	Init. Prod. Bbls.	Depth
ECTOR COUNTY—		
Continental Oil Co., T. P. Land Trust 2-A	1200	4255
HOWARD COUNTY—		
Humble O&R Co., W. R. Settles 6	795	2336
PECOS COUNTY (Yates Field)—		
Pecos Production Co., J. H. Tyler-State 1 (24.4-ac)	53,625	1344
WARD COUNTY—		
A. R. Eppenauer Drl. Co., G. S. Combs 1-B	190	2423
Sid Richardson et al, Johnson-Sun 4-B	550	2518
Tex-Mex Pet. Corp., S. S. Owens-Llano 3	480	3036
WINKLER COUNTY (Scarborough Field)—		
Sid Richardson et al, Scarborough 1-H	155	3027

*Failures; †Junked; ¶Million cu. ft. gas.

Calhoun County

San Antonio, Texas.—Continental Oil Company is experiencing considerable difficulty with heaving shale in its American National Realty Company (Moody) deep test in Calhoun County. At 6625 feet it appeared that the well might have to be abandoned, but it finally was cleared and a string of 7⅝-inch casing run to that level. It was originally intended to set this string at 8000 feet. The hole is now being deepened, bottomed at 6655 feet, and the casing is to be carried down with the hole.

Lower Proration Quotas Lower North Texas Surplus

Wichita Falls, Texas.—Supply of crude production in the North Texas district in excess of market demand has been reduced to a negligible volume as result of the imposition of more stringent proration quotas and the absorption of about 4200 barrels daily by Magnolia Petroleum Company. Relief afforded by the latter concern enabled the Waggoner Refining Company to announce on October 4 the cancellation of its enforced crude storing arrangement that had been in effect for several weeks.

Magnolia Petroleum Company relieved Waggoner Refining Company of 2300 barrels, or more than 50 percent of its crude runs in Wilbarger and Wichita Counties. The former also connected to about 1000 barrels of Archer County production formerly purchased by The Texas Company, and 900 barrels daily was diverted from Continental Oil Company.

Allowable production of the district was reduced about 6000 barrels daily effective October 1 when all prorated wells were restricted to five percent of their potential output after allowing for marginal well quotas. The new order also limited shallow acid treated wells to a maximum potential of 300 barrels daily, thereby fixing a top allowable of 24½ barrels daily for all wells in Archer County's shallow lime belt, instead of 39 barrels daily.

Revised proration schedule prepared on the district as of October 1 by G. A. McWhirter, Commission supervisor and proration referee, records a potential output of 106,940 barrels daily, with an aggregate allowable of 57,569 barrels daily. The district has an allotted quota of 56,500 barrels daily. These figures are exclusive of the special schedule set up for The Texas Company's three large flowing wells on the Johnson ranch, western Foard County. The latter have been prorated to 1500 barrels daily.

Expect Early Completion Of Tests in Cole Field

San Antonio, Texas.—Several more completions are expected over the week end in the deep sand of the Cole field, in the extreme eastern portion of Webb County.

American Liberty Oil Company was coring for the 3400-foot sand in both Bruni 5 and Bruni 1-B, while Herman Brown's Bruni Estate 1, total depth 3408 feet, was drilling out plugs. O. W. Killam plugged back Bruni 25 from 3434 feet to shut off salt water, and has set and cemented pipe on Bruni 27 on the same sand. Sun Oil Company is near 3000 feet in Bruni 1.

Two miles east of the field, United Production Company and Magnolia Petroleum Company's B. Benavides 5, is drilling at 3740 feet. Cole Petroleum Company's R. Benavides 86 is drilling at 3900 feet. Both wells showed salt water in the 3400-foot sand.

San Antonio, Texas.—Late in the week, Albert Plummer et al's Zimmer 1, in the Colletto Creek field, Victoria County, was coring for the deep sand just below 4400 feet. His Terrell 2 had the second oil producing sand at 2830-36 feet and was testing. The only other active operation in the field is American Liberty Oil Company's Prybl 1, which is rigging up.

Frio Deep Test

San Antonio, Texas.—Amerada Petroleum Corporation's Halff & Oppenheimer 2, Frio County deep test, is shut down at 8983 feet. It is waiting on commercial drilling mud. This well likely will be carried considerably deeper before abandoning if production is not found.

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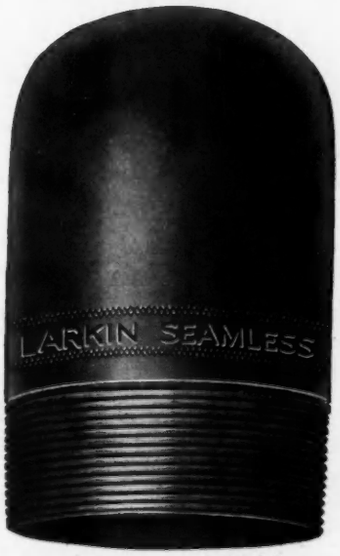

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Sam Fordyce Promises Most Activity Known in South Texas

San Antonio, Texas.—The true picture of the Sam Fordyce field, Hidalgo County, likely will be displayed within the next several days as a result of the rapid drilling campaign underway. Two wildcats in opposite directions from the discovery well have the sand and several more are due to core it within the next few days.

Alamo Drilling Company provides a 1700-foot south and east extension with Ed. Sullivan 1, showing for a big producer in the sand at 2769-80 feet. Casing has been set and plugs are being drilled. Moncrief & Showers have set casing above the sand at 2757-65 feet in F. B. Guerra 1, located 1500 feet northeast of the discovery well.

Aside from the coring of the producing sand in two outpost wells, the first to reach the producing level since the field's discovery several weeks ago, the action of the discovery well was the most important happening of the week. This well is Otto Woods' Lawrence 1, completed originally September 20 at 2753 feet for an initial flow of slightly in excess of 1000 barrels per day on choke.

The well developed such a great pressure that it started flowing gas around the outside of the casing October 8, and the ground began to shake, indicating that the well may go on a rampage and run wild, possibly resulting in a crater. The valves were opened and the well allowed to flow through two two-inch flow lines into storage tanks and into earthern pits. The flow was rated at well in excess of 5000 barrels per day. October 10. it was reported that the well was making between 350 and 370 barrels per hour, or nearly 9000 barrels per day, one of the largest producers ever completed in the Coastal area of the South Texas district.

While running wide open, the well retained a pressure on casing of 800 pounds, while the tubing pressure was 400 pounds. No water was coming with the oil.

The Texas Railroad Commission has ordered the well killed, but it is likely that engineers will be called in to devise a plan for handling of the well before this is done. It is possible that the well will be circulated, recemented and brought back into production.

Approximately 75 locations or active wells are reported in the field during the first three weeks of its existence. Should several important outpost wells develop into commercial producers, it is likely that this number will be greatly increased. The land is divided into small tracts, ranging downward from 100 acres. Scores of independent operators hold leases, sufficiently spotted that it will be a proposition of offsetting.

The production in this field undoubtedly will be controlled by a series of faults running north and south through the anticline. The structure itself is in excess of 20 miles in length, large portion of which is in Mexico. It has one saddle just south of the Rio Grande, but it is not likely that the entire structure will produce in the 2750-foot sand, due to sand lensing and faulting.

It can be said, however, that the heavy production, small tracts, and number of independent lease holders, will bring about possibly the greatest drilling campaign in the history of South Texas. The most important thing will be the control of activity to prevent dissipation of pressure.

New Field in Prospect In Northern Live Oak

San Antonio, Texas.—A new field in northern Live Oak County seems in prospect as Henderson Coquat et al attempt to complete Jacob's 1 in the Pettus sand. The well showed considerable oil and gas and some salt water in the sand at 1805-26 feet a few days ago and has been plugged back, whipstock set and the well will be sidetracked to re-core the sand. It is believed that too much of the sand was taken and the majority of the water is from the bottom.

The well is located 660 feet from the north and east lines of Tract 27, Charles R. Tipps subdivision, Everett and Henry surveys.

Sinton Extension Well Showing in Deeper Sand

San Antonio, Texas.—A second producing level and a material extension to the east was considered likely late in the week in the Sinton field, San Patricio County. Heep Oil Corporation's Welder 4, tested 400 feet of oil, 900 feet of mud and oil and 2700 feet of salt water in a sand at 6614-61 feet. It is likley that the well took too much sand and it is being plugged back for a new drill stem test. This is the best showing thus far made on a drill stem test in the area.

The Heep well is the fifth well to be drilled in the Sinton field and is the deepest. Three wells have been completed in the 5400-foot sand as gassers spraying distillate and a fourth was abandoned, but possibly could have made some sort of a gasser in the 5400-foot sand. The Heep well showed for a similar producer in the first producing sand in the field, but was carried deeper.

Commission Fixes Rules For South Texas Fields

Austin, Texas.—The Texas Railroad Commission has issued a series of new field rules effective on October 10 which will apply to five Southwest Texas fields. A separate set of rules was promulgated for each field.

The rules for the two Government Wells fields in Duval County have been revised, according to recommendations of E. C. Rach, resident petroleum engineer for the commission.

Rach's recommendations were presented at a lengthy hearing held in Austin last Monday. They were designed to prevent waste of gas and to provide uniform rules for both fields, which are connected according to evidence presented by the engineer. Rules for the North field have for some time provided for one well to 10 acres. This rule is now applied to the South field, where the rule applicable to the state generally, calling for the spacing of wells 150 feet from lease lines and 300 feet apart, had been in effect. A maximum gas-oil ratio of 1000/1 was included. This rule had been in effect in the South field, but the allowance was 1250/1 in the North field, where a larger volume of gas is found in the reservoir.

Testimony presented at the hearing indicated that many wells had leaky connections, and that several were producing with excessive gas-oil ratios. To correct these conditions the commission has provided that gas-tight connections must be placed on every well. All flowing wells must be provided with separators, and residue gas burned in flares. Meters are now required on all wells with a gas-oil ratio above 1000/1. These wells would be placed on a total displacement allowance, which is 60,000 cubic feet per day under the orders as revised.

The commission had received reports that the allowable for wells off production had been run from other wells on the same lease. This practice is strictly prohibited by the new order.

Piedras Pintas

A maximum gas-oil ratio of 1000/1

was fixed for wells in the Piedras Pintas field in Duval County. Since this field is on a salt dome, no spacing rule is provided, and the wells may be drilled wherever the operators desire.

Because of the heavy gas encountered, the commission has included several provisoins for its control. Ten-pound mud must be used when drilling through these gas sands, and blow-out preventers and other equipment of this type are required.

The same rules for controlling the gas are provided in those issued for the new Bruni deep sand field in Webb County. The maximum gas-oil ratio is fixed at 1000/1. Wells must be spaced one to 10 acres under provisions of the permanent rules.

Rules for the Sam Fordyce field in Hidalgo County also include the complete gas control program. Wells are to be spaced one to 10 acres, as provided in the temporary rules.

Enforcement of the spacing rule in this field will probably prove difficult, since there are many tracts of two or three acres, each of which has been under separate ownership over a long period.

South Texas Completions Well Scattered

San Antonio, Texas.—All portions of South Texas contributed to new production column during the past week: Completions are as follows:

Company, Well and Location	Init. Prod. Bbls.	Depth
DUVAL COUNTY—		
Al Buchanan, Duval County Ranch 4, sec 206	100	1497
Humble Oil & Ref Co., Paul White 44, sec 58	216	2302
Magnolia Pet Co, Duval County Ranch 12, sec 59	240	2229
Duval County Ranch 35, sec 209	192	2323
FAYETTE COUNTY—		
Magnolia Pet Co, Steinman 1, Almansure sur	*	3725
GOLIAD COUNTY—		
Nichols-Hindeman et al, Lackey, Weldon 1, Javaiano Gomez sur	*	4025
LIVE OAK COUNTY—		
Houston Oil Co, Cartwright 27, Colorado sur	175	3505
McMULLEN COUNTY—		
Brasada Oil Co, Nueces Land & Live Stock Co, 1, sec 111	*	2010
C. R. Kennon, Trustee, H. L. Lark 3, Blk 15, Scrugham sur	10	1050
Slimp & Hockaday, H. L. Lark 1, Blk 1, Scrugham sur	8	1032
REFUGIO COUNTY—		
Houston Oil Co, Rooks 16, Mullin sur	360	4915
Humble Oil & Ref Co, J. F. B. Heard 12	168	4383
O'Connor 16, F. Rios sur	80	3040
WILLIAMSON COUNTY—		
G. L. Rowsey, Trustee, W. Heap 1, H. White sur	3	1025
ZAPATA COUNTY—		
A. J. Mickle, Trevino 1, Blk 14, sec 411	30	1635
Texas Co, Whitehead 55, Cerrito Blanco Grant	15	1240

*Failures; †Junked; ¶Million cu. ft. gas.

Kittrell Has Two Producing Wells and Five Failures

Houston.—The second producer and fifth definite failure for the new Kittrell field of Houston County comprised the past week's activity for the area when Humble Oil & Refining Company completed Shaw 1 for 31 barrels per hour, L. S. Flannery, Inc.'s Texas Long Leaf Lumber Company 1, was abandoned at 2136 feet and East Texas Production Company's Texas Long Leaf Lumber Company 1, finaled at 2524 feet. Hooper Oil Company's Duren 1, abandoned at 2137 feet. Boone Brothers' Texas Long Leaf Lumber Company 1, completed at 2270 feet.

Humble Oil & Refining Company's Shaw 1, 660 feet northwest of the discovery well and 511 feet from the northeast line and 287 feet from the southeast line of 131-acre tract in the C. McEllis Survey, was completed for 744 barrels of oil daily through a half-inch choke with a tubing pressure of 120 pounds and casing pressure of 600 pounds. Bottom of the hole is 2077 feet. On a recent drill stem test from 2060 to 2077 feet the well showed 240 feet of oil in six minutes through a quarter inch choke on top and bottom with no prsesure. Six and five eighths-inch casing was set at 2060 feet. This test was the second producer for the new field. The operators are drilling M. Shaw 2, 660 feet southwest of Shaw 1, and 1171 feet southwest of the northeast line, 330 feet northwest of the southeast line in the C. McEllis Survey at the close of the week the operators were setting surface casing at 298 feet.

The second definite failure for the field was L. S. Flannery's Texas Long Leaf Lumber Company 1, 2½ miles southeast of the Kittrell area and in the M. Milsap Survey. The well was dry and abandoned at 2136 feet. This test was a tight well with information being withheld by the operators but it was reported that the well topped the Crockett at 1375 feet and the Sparta at 1782 feet with an elevation of 290 feet. On the geological markers compared with the discovery well the test was running about 100 feet lower then the first producer.

The third definite failure for the area was East Texas Production Company's Texas Long Leaf Lumber Company 1, one mile southwest of the discovery well and 330 feet from the south and west line of 30-acre tract in the F. Willis Survey. The hole was bottomed at 2524 feet. On a drill stem test from 2000 to 2020 feet the well showed five stands of fresh water in five minutes through a quarter-inch choke. It then was drilled to the abandoned depth. With an elevation of 260 feet the well picked up the Crockett at 1368 feet and the Sparta at 1779 feet and as compared to the discovery well was running over 150 lower than the first well for the new field.

The fourth failure for the field was Hooper Oil Company's Duren 1, 330 feet northeast and 237 feet northwest from the northeast corner of C. McEllis Survey, on a vacant strip approximately 27 acres. The well is southeast of the discovery well. The bottom of the hole in the failure was 2137 feet. Elevation is 281 feet.

Boone Brothers' Texas Long Leaf Lumber Company 1, 660 feet north of the discovery well and in the C. McEllis Survey, was completed as a dry hole at 2270 feet. This well remained shut down for some time waiting on the outcome of Humble Oil & Refining Company's Texas Long Leaf Lumber Company 1. The latter well had missed the pay sand found in the discovery well so Boone Brothers decide to abandoned their test. This test makes the fifth definite failure for the new field.

The field now consists of two oil wells and five failures. However several of the other wells look disappointing. Boone Brothers' Texas Long Leaf Lumber Company A-1, 733 feet south of the discovery well, was laying water lines. Crown Central Petroleum Company's Texas Long Leaf Lumber Company 1, northeast of the discovery well, was rigging up. Humble Oil & Refining Company's Texas Long Leaf Lumber Company 1, was drilling shale at 2610 feet, having a slight odor of gas from 2495 to 2498 feet, Lacy & Miller's J. H. Hanner 1, two miles east of Weldon, was shut down for water at 1392 feet. In Walker County, Barnett et al's Reynolds 1, 2000 feet southeast of the discovery well, was drilling shale at 1750 feet and Lion Oil Company's Stokes Heirs 1, 2½ miles southwest of the discovery well was coring at 1950 feet.

The Texas Company is making location to explore its recently acquired 2000-acre block out of the Thompson

Brothers' 3468-acre tract in the northwest part of the Jose Ortega Survey in Walker County. It is reported that Texas Company paid $10 per acre and assumed a drilling obligation to start a test within 60 days of September. The Texas Company is making this exploratory test on the theory that there is a structure that is entirely separate from the new Kittrell field of Houston County.

In Trinity County, Gulf Refining Company is reported to have paid $50,000 for 80,000 acres out of the Trinity County Lumber Company's acreage scattered throughout the county. It is reported that a drilling obligation went with this purchase. Gulf Refining Company agreed to drill six wells the first to start with in six months and then one well each 30 days after completion of the previous test. In Walker County, Boone Brothers is reported to have purchased 400 acres from the Texas Long Leaf Lumber Company centering around the K. Kictman Survey, two miles south of the discovery well. Consideration was $150 per acre out of oil.

A special lubricator has been installed on the Boone discovery well, also steam coils in the settling tanks to treat the oil. The well has made approximately 12,140 barrels of oil up to October 7.

Rules Issued for Kittrell Field Development

Austin, Texas.—The Texas Railroad Commission has issued permanent field rules for the new Kittrell field in Houston, Walker and Trinity counties, which became effective on October 10.

The new regulations are less stringent than requirements in the temporary rules, as testimony at a hearing held in Austin last Monday indicated that operators would have little difficulty in maintaining control of their wells. The 10-acre spacing rule was retained.

The most important change, from the operators' standpoint, was the reduction in test requirements. The temporary rules provided for 1900-pound tests on casing, which operators declared to be excessive. Little gas is encountered and the wells are relatively shallow. For those reasons a test at 100 pounds, which may be handled with a single pump, has been provided.

Cement, however, must still stand 48 to 72 hours as provided in the temporary rules. Major company representatives protested that they obeyed this regulation while many of the smaller concerns drilled plugs in less time, regardless of commission rules.

Gulf Coast Operators Complete 22 Tests

Houston. — Completions along the Texas Gulf Coast during the past week showed an increase over the previous week when the area registered 22 completions. Of these, 13 resulted in producers with an initial production of 4676 barrels daily. There were nine failures.

In the Danbury field, Brazoria County, Shell Petroleum Corporation's F. Schmidt A-1, J. H. Brunner Survey, was abandoned at 2540 feet after making a drill stem test from 2510 to 2540 feet. It showed 300 feet of salt water and 75 feet of sand and mud through a quarter-inch choke on top and bottom in 10 minutes. The same operator's Haury 3, in the same field and in the H. & T. B. No. 13 Survey, was running 9⅝-inch casing at the close of the week with the bottom of the hole being 6290 feet.

In the Livingston field of Polk County, Gem Oil Company's Cavanaugh & Collins 1, A. Viesca Survey, was finaled from 4237 feet for 180 barrels per day through a quarter-inch choke with a tubing pressure of 1400 pounds and casing pressure of 1580 pounds. Two and half-inch tubing was run to 4230 feet and first two hours the well made 15 barrels of oil through a quarter-inch choke, three percent wash water. Operculina was topped at 4108 feet and the Cockfield at 4121 feet. Smith & McDaniel and Shell Petroleum Corporation's Davis & Holmes 1, A. Veisca Survey, was found to be dry at 4425 feet after topping the Fayette at 3000 feet, Massilina Pratti 3475 and the Hockleyensis at 3515 feet.

Another producer was added to the Arriola field, Hardin County, when Republic Production Company's Arriola Fee 3-X, 400 feet east of Arriola Fee 6, was completed for 218 barrels of 24.1 gravity oil per day. The flow was through a three eighths-inch choke with a tubing pressure of 620 pounds and casing pressure of 850 pounds. The same operator's Arriola Fee 8, Arriola League, was preparing to perforate casing from 4520 to 4585 feet. On an electrical logging device an oil sand was found at that depth. On a recent drill stem test from 4490 to 4513 feet the well showed salt water and oil. Several tests have been made on the well and each one of them showed salt water and some oil. Core barrel was twisted off at 5042 feet.

Two miles southeast of Julliff, Turnbull & Irwin's Braden 1, 247 feet from the west line and 220 feet from the south line of a 53.3-acre tract in H. & T. C. Section 53, was abandoned during the past week after testing salt water at 6857 feet. The well topped the Miocene at 3195 feet, Discorbis 5596, Heterostegina 6160, and Marginulina at 6378 feet.

Company, Well and Location	Init. Prod. Bbls.	Depth
ARRIOLA—		
Republic Prod. Co, Arriola Fee 3-X	218	3086
BARBERS HILL—		
Texas Gulf Prod. Co, Eberspacher 2	187	5333
BOLING—		
Irwin & Larson et al, J. R. Farmer 1	*	lcn.
CLAY CREEK—		
Sun Oil Co, Janner 10	360	1300
CONROE—		
Humble, Madely State Land 1	576	5127
DANBURY—		
Shell, F. Schmidt A-1	*	2540
HULL—		
Gulf, Phoenix 105	179	4435
KITTRELL—		
Hooper Oil Corp, Duren 1	*	2137
Humble, Shaw 1	744	2077
LIVINGSTON—		
Gem Oil Co, Cavanaugh & Collins 1	180	4237
Shell and Smith & McDaniel, Davis & Holmes 1	*	4425
LOUISE—		
Pure Oil Co, K. P. Adams 1	74	5150
MANVEL—		
Harrison & Abercrombie, F. Elving 1	305	4034
MARKHAM—		
Rio Bravo, R. J. Sisk et al 1	*	4056
PIERCE JUNCTION—		
D. D. Cogswell, Herman Hospital 1	700	3668
SOUTH LIBERTY—		
Humble, Welder 10	187	4996
THOMPSON—		
Gulf, Hamstrom 5	864	5310
TOMBALL—		
Texas Co, Hirsch 4	102	5610
BRAZORIA COUNTY—		
Turnbull & Irwin, Braden 1, 247 ft fr w line, 220 ft fr s line of 53.3 ac tr in H.&T.C. sur, sec 50	*	6857
HARRIS COUNTY—		
Foster et al, Johnson 1, 2000 ft fr s line, center of e and w of C. C. & S. R. sur	*	lcn.
WALKER COUNTY—		
East Texas Prod Co, Tex L. L. L. Co 1, 330 ft fr s and w line of 30 ac tr in F. Willis sur	*	2524
L. S. Flannery Inc, Tex L. L. L. Co 1, 150 ft fr n line, 350 ft fr county line on a 5 ac tr in M. Milsap sur	*	2136

*Failures; †Junked;, ¶Million cu. ft. gas.

Hankamer Extended

Houston.—The Hankamer field of Liberty and Chambers Counties, was extended to the west 1015 feet when George Devore's S. E. Ezzell et al 1, 400 feet from the north line and 150 feet from the east line of 175-acre tract in the L. Barrow Survey, came in at the estimated rate of 15 barrels per hour.

Ezzell 1 had oil sand from 2595 to 2615 feet, making a total of 20 feet of saturated oil sand. Six and five eighths-inch casing was set at 2580 feet. The oil is 20.3 corrected gravity with a temperature of 78 degrees.

Nearest production in the field is Gulf Production Company's Boyd 15, which is making approximately 100 barrels of oil daily along with some salt water.

Second Producer Shows In New Travis Area

San Antonio, Texas.—Humble Oil & Refining Company apparently has a second producer in the new Kimbro field of Travis County, recently opened by the company. Buck Christian 1-B, Kemp Survey, is at 757 feet and in process of completion. It has casing set at 642 feet.

The first well, Peterson 1, same survey, is at 740 feet, flowing several barrels of oil per day. It is waiting on pumping equipment.

Government Wells

San Antonio, Texas.—Government Wells field, the largest yet developed in South Texas, continues to add to its long list of producers, now nearing the 600 mark. During the past week, there were 10 added to the field, proportioned as follows: Bridwell Oil Company, 1; Edgington & Murray, 1; Highland Oil Company, 1; Humble Oil & Refining Company, 2; Magnolia Petroleum Company, 2; Reed & McKay, 1; Smith & Storey, 1; Sun Oil Company, 1.

Driscoll Field

San Antonio, Texas.—Continental Oil Company is finishing its third well in the deeper sand of the Driscoll field, Duval County. Clara Driscoll Sevier 3-A, Section 23, went to 3710 feet, plugged back to 3350 feet, and set casing, which will be perforated at 3311-25 feet to complete as gasser.

West Tuleta

San Antonio, Texas.—Edwin M. Jones failed to develop production in the Yegua sand in D. E. Robinson 3, Uranga Grant, West Tuleta field, Bee County. The well drilled to 4405 feet and has been plugged to 3940 feet. Casing is set at 3910 feet. Pettus sand showed gas at 3910-37 feet.

Dickinson

Houston.—Humble Oil & Refining Company's Maco Stewart 1-B, 410 feet south of the Dickinson Bayou and in the new Dickinson field of Galveston County was approaching completion depth at the end of the week with the geological markers checking normal with the discovery well. Nine and five-eighths-inch casing was set at 7727 feet.

Pure Oil Company's Schelor 1, across the Dickinson Bayou from Humble Oil & Refining Company's discovery well, in the B. B. B. & C. Survey, was waiting on cement at 6989 feet; after encountering the Discorbis at 6555 feet and as compared to the discovery well it is running normal. The discovery well was abandoned after it caught fire in August. It was abandoned at 7881 feet. The well was making a large volume of gas and some distillate.

Leasing continues brisk in the area with one of the major companies purchasing 15 acres to the northwest of the discovery well for $300 cash and the same amount out of oil per acre. The purchase was in the P. G. Merritt Survey. A 15-acre tract in the B. B. B. & C. Survey brought $165 per acre and this was purchased by an independent operator.

San Antonio, Texas.—R. P. Whitfield's L. Jacob Corporation 1-A, located in the centeral portion of the southwest of Section 17. GH&H Survey, mile and half northwest of the Jacob field, McMullen County, is in process of completion. The well topped the shell bed at 914 feet, took a saturated core to 922 feet and set casing. Plugs have been drilled and the well is being drilled into the sand dry preparatory to testing. It looks like another producing spot in the Pettus sand in the Jacob area.

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Hobbs.....Republic Supply Co.

OKLAHOMA

Ada.....Republic Supply Co.

TEXAS

Beaumont...Peoples Lumber Co.
(Stock at Beaumont Bldg. Mat. Co.
Buffalo.....Republic Supply Co.
(Warehouse C. O. Glenn)
Cleveland...Peoples Lumber Co.
Conroe.....Republic Supply Co.
Conroe....Stahlman Lumber Co.
Dayton.....Peoples Lumber Co.
Houston....Republic Supply Co.
McFaddin.Republic Supply Co. or
McFaddin...Anchor Lumber Co.
(Victoria)
McFaddin....(Stock at McFaddin
Merc. Co.)
Mont Belvieu.Peoples Lumber Co.
Odem....Southland Lumber Co.
Odessa....Stahlman Lumber Co.
Refugio....Republic Supply Co.
Refugio....Stahlman Lumber Co.
Sinton.....Republic Supply Co.
Sinton.....Turner Lumber Co.
Sour Lake...Peoples Lumber Co.
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Tomball....Stahlman Lumber Co.
Vanderbilt.Stahlman Lumber Co.
Victoria.....Anchor Lumber Co.
Victoria....Republic Supply Co.

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South Liberty Extension Well Producing From New Sand

Houston.—Humble Oil & Refining Company's Welder 10, 400 feet south of Welder 9, W. Duncan Survey in the South Liberty field, Liberty County, was completed October 11 making 187 barrels of oil per day to extend the field to the west and also discover a new producing sand for the dome.

Tubing was hung at 4986 feet with 253 feet of screen and 94 feet of blank screen being set. On the first 24-hour gauge the well made 187 barrels of 41.8 gravity oil with a temperature of 70 degrees through a three-eighths-inch choke. Tubing pressure was 800 pounds and casing pressure 1050 pounds. Bottom of the hole is 4996 feet. The well has been pinched back and the chokes are being adjusted.

Not only was this well the discovery well for the new deep sand but it also extended the field to the west and was the deepest test to be drilled in the field. Empire Gas & Fuel Company's O'Brien 13, was abandoned as a dry hole in September, 1930, at 4594 feet as the previous deepest test.

On the discovery well 10-inch casing was cemented at 1209 feet and seven-inch at 4726 feet with 365 sacks of cement. On a drill stem test from 3615 to 3625 feet the well showed 180 feet of mud and sand showing oil. The tester was open 10 minutes. A quarter-inch choke was used on top and bottom. At 2943 feet the operators plugged the well back to 2600 feet to straighten the hole and drilled to 3662 feet where the deep test had a showing of oil. On approximately 20 cores taken from 3747 to 4984 feet, the well showed oil and gas on each core. When the operators prepared to run screen, trouble was encountered with the heavy gas pressure. A heavy drilling mud was pumped into the hole. While reaming to 4740 feet, the shale heaved in, the operators were forced to mix a special drilling mud, soda and acid, to keep the hole from caving. The operators were then successful in reaming to the bottom to set the screen.

This discovery well for the new deep sand encountered the Discorbis at 3499 feet, Heterostegina 3580 feet, Frio 3618, Vicksburg 3787, Hockleyensis 3815, Dibollensis 4165, Operculina 4276, Upper Saline Bayou 4675 and Anhydrite at 4993 feet.

No doubt other wells that have been completed at a shallower depth in the South Liberty field will be drilled deeper. The producing formations heretofore were in the cap rock, Oligocene, Jackson and Claiborne sands found around 1000 feet and from 2000 to 3900 feet.

The South Liberty field is three miles south of Liberty in Liberty County, centering around the M. G. White, D. Minchey, Wm. Duncan and Elizabeth Munson Surveys. The field was discovered by sulphur springs and gas escapes and oil seeps. The field consists of about 250 productive acres and the principal lease holders are Navarro Oil Company, Sun Oil Company, Bashara Oil Company, The Texas Company, Humble Oil & Refining Company, Gulf Production Company, Empire Gas & Fuel Company, Magnolia Petroleum Company, Fort Bend Oil Company and Yount Lee Oil Company.

Pierce Junction Well Blows Out at 6100 Feet

Houston.—Gulf Production Company's Cain 9, J. Hamilton Survey, at Pierce Junction, blew out late Wednesday night and continued to make gas all day Thursday and was killed Thursday night. The well blew out while the operators were drilling below 6100 feet. There was no estimate on the volume of gas. The drill stem is stuck in the hole and at the close of the week the operators were fishing.

This well was originally drilled to 4000 feet and completed for 500 barrels of oil per day through a quarter-inch choke with a pressure of 400 pounds. The operators decided to carry the hole on down to test lower formations. It is one of the deepest holes in the field.

Second Producer Completed at Van Vleck

Houston.—The second oil well for the Van Vleck field of Matagorda County was completed late last week Skelly Oil Company's Cobb 2 came in for an estimated 200 barrels per day through a three eighths-inch choke.

Seven-inch casing was set at 7043 feet after a drill stem test was made from 7030 to 7061 feet. The well showed 270 feet of oil through a quarter-inch choke on top and a three eighths-inch choke on bottom. The test was made in 10 minutes with a 250-pound pressure. Screen was set and the well came in and at the close of the week there was no definite gauge on the well. The operators were changing the chokes. The estimated gauge was 200 barrels of 40 gravity oil through a three eighths-inch choke with a tubing pressure of 1750 pounds and casing pressure of 1920 pounds.

Liberty County Wildcat Centers Coast Attention

Houston.—Jack Frazier's Buffon 1, three miles south of Wilcox Oil & Gas Company's 6033-foot dry hole, James Robeson Survey of Liberty County, attracted attention last week when heavy gas pressure was developed above 4503 feet. While pulling the drill pipe from 4503 feet to change bits, the well started flowing mud. After 15 thribbles had been pulled, the flow was strong enough to necessitate pumping in additional mud. After pulling 10 more thribbles, the mud flow increased. At this point 120 sacks of weight material was used to bring the well under control. The remainder of the pipe was pulled and three cores taken below 4503 feet. The formation was shale with no shows. This indicated that the gas was coming from above 4503 feet. The operators at the end of the week were shut down at 4748 feet, repairing the boilers.

This test holds the attention of the oil operators on the Texas Gulf Coast, and is reported the hottest wildcat in the area. On geological markers, the well is running over 300 feet higher than other wells drilled in the area. Wilcox Oil & Gas Company's Cousins 1, to the north of Buffon 1, in the J. Knight Survey, with an elevation of 59 feet, topped the Discorbis at 3946 feet, while the Buffon 1, with an elevation of 50 feet encountered the formation at 3610 feet making the latter test run 336 feet higher than the abandoned test. On the Frio marker Cousins 1 topped the formation at 4405 feet and the Buffon well at 3946 feet, making the Buffon 1, 459 feet higher. Two miles south of Jack Frazier's Buffon 1, Seal Oil Company's Finley 1, in the A. S. Hardin Survey, was abandoned at 5038 feet some time ago. This test topped the Discorbis at 3825 feet and the Heterostegina at 4125 feet. As compared to Jack Frazier's well on the Discorbis marker, the latter test was running approximately 215 feet higher. On the Heterostegina marker, Buffon 1 topped this formation at 3946 feet and the abandoned test at 4125 feet making the Buffon 1 179 feet higher than Finley 1, on the Heterostegina.

Jack Frazier originally took all the leases in the area and has sold spreads to Humble Oil & Refining Company, Gulf

Production Company, Atlantic Oil Producing Company, Sun Oil Company, Magnolia Petroleum Company, Crown Central Petroleum Company, Foroy Petroleum Company, L. W. Wickes and others. Several of the companies purchasing in this area have made geophysical surveys. Also the paleontological record of the wells drilled in the area disclose a sub-surface high. It is generally believed that this high will be proven by the drilling of this test. Contract for the drilling of the test was let to Woodley Petroleum Company and Turnbull & Irwin, for a cash consideration and an acreage interest. The above two companies sublet the drilling contract to Sam Parton of Shreveport, Lousiana.

The well was spudded September 12, 1934, and is equipped with a rig of sufficient size to carry the well to a depth of 9000 feet. However, the contract depth is 7500 feet which is believed sufficient to test the Conroe sand or the principal producing horizon in the Cockfield formation. The official name of the well is Jack Frazier, Turnbull & Irwin and Woodley Petroleum Company's Lynott Buffon 1. The ownership of the lease on which the well is being drilled is as follows: Jack W. Frazier, half, Turnbull & Irwin, quarter, and Woodley Petroleum Company, quarter. The wildcat is 466 feet south and 466 feet east of the northwest corner of the southeast 100 acres of the west 400 acres of 865-acre tract or 6410 feet west of the east line and 466 feet north of the south line in James Robeson Survey.

An exploration company is working around the well with reflection instruments. It was reported that Humble Oil & Refining Company is purchasing all acreage northeast, east and southeast within three miles of the wildcat for $50 per acre, and $100 per acre within one mile of the test.

Four and half miles northeast of the Buffon well and four miles south of Davis Hill in Liberty County, Liberty Independent Oil Company's J. M. Neal 1, S. Strong Survey, was drilling at 2541 feet at the end of the week. This test has been a mystery well for the past three months and it was reported that it had a mud blowout at 2225 feet and for several weeks was shut down installing a new boiler. Gem Oil Company is reported to have purchased 136 acres in the R. Coleman and the S. Strong Survey for a cash consideration of $832.

In the Cleveland field, Gulf Production Company's Kirby C-6 was drilling at 5590 feet at the end of the week. Kirby C-6 is located 1000 feet west of the recent producer, Kirby C-5 and on the geological markers it is reported to be running lower. This well should reach the producing formation for the Cleveland field the first part of this week.

San Felipe Well Flows Oil When Deepened

Houston.—A flow estimated by the operators at 2500 barrels per day resulted last week when Capps & Sloan's Vaughn 1, San Felipe discovery producer, was deepened to 2979 feet. The well was shut in when available lease storage had been filled. No gauge was made of the gas pressure accompanying the flow. The oil is 22.8 gravity.

Vaughn 1, located in the J. McFarland Survey, Waller County, originally was drilled to 2970 feet, had an oil sand from 2952 to 2965 feet, and seven-inch casing was set at 2954 feet. After swabbing for several hours 1500 feet of clean oil showed up in the tubing, showing no salt water and a temperature of 89 degrees. Efforts to induce flow were unavailing and the well was put on the pump, at four-hour intervals yielding oil which aggregated 15 barrels per day. Deepening then being decided upon, the lower production came in through the drill stem while coring and a core barrel is at the bottom.

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Calcasieu Parish Well Seen as Field Opener

Houston.—Union Sulphur Company's Barbee Estate 2, seven miles northeast of Lake Charles and on the north bank of the Calcasieu River in Section 12-9s-8w, is the discovery well for the new Gillis field of Calcasieu Parish. Late last Friday evening the wildcat was washed in making an estimated 75 barrels per hour by heads.

The discovery well cleaned itself and would flow by heads for 15 or 20 minutes of each hour and then go dead. There was no gas pressure. Gravity of oil ranged from 38 to 40 degrees, with some of the scouts at the well stating that it is the same as that in the Iowa field of Jefferson Davis Parish. Some sand but no salt water accompanied the oil.

The bottom of the hole is 6772 feet with 6⅝-inch casing set at 6760 feet, with 21 feet of 4½-inch of 80-mesh screen was set. Last Wednesday the plug was drilled on the test and the operators cored into the sand on Thursday. Tubing and screen were made up Friday and the well brought in Friday night.

The hole was carried to 7916 feet and then plugged back to 6631 feet after running an electrical logging device, which showed 15 ohms at 6750 feet. A 38-foot body of sand was shown from 6745 to 6783 feet.

The well is producing from the Marginulina formation of the Middle Oligocene series and is reported to be running higher than the Iowa field of Jefferson Davis Parish. Reports from the well state that the operators think they are on the edge of the structure which is thought being the reason for no gas pressure on the discovery well.

This area is called the Gillis and sometimes it is referred to as the English Bayou district. It was discovered on surface geology and seismograph reflection. Three tests have been drilled in the area by Union Sulphur Company. J. C. Stout 1, Section 36-8s-3e, was abandoned at 7998 feet, Barbee Estate 1, one mile northeast of the discovery well, was finaled at 8125 feet. It is reported that the Barbee Estate 2, was running higher than the abandoned test. The third well to be abandoned was Castle 1, Section 14-8s-3e, the bottom of the hole was 4200 feet.

Fohs Oil Company of Houston is contemplating a test in the new field. Union Sulphur Company has made location for State 1, north of the discovery well, and at the close of the week was drilling in shale at 4102 feet.

This field is the first to be discovered in the South Louisiana Coastal area since the discovery of the Bosco field of Acadia and St. Landry Parishes.

H. C. Cockburn of Houston originally took leases in the vicinity of the well and in turn interested Union Sulphur Company in drilling the test. He retains an overriding royalty. One of the largest lease plays in the history of South Louisiana has been underway in this area for the past six months with several of the major oil companies taking large spreads near Union Sulphur Company's large block. The estimated total of $100,000 in royalty has been purchased in the block, and as high as $200 per acre for a few small outstanding tracts more or less favorably located. Gulf Refining Company has acquired leases on 80 acres, located through the east edge of Section 15-9s-8w, paying an average bonus of about $25 per acre with half that amount as annual rentals, five-year leases. These small tracts were about all that were available close to the west side of the Union Sulphur Company's block. A mile to the southwest, Sun Oil Company has a lease from Markus Michie covering 35 acres in SW NE Section 14-9s-8w, paying a cash bonus of $1000 for the first year, with $10 rental per acre, five-year lease. Union Sulphur Company recently leased the W. B. Conover 80 acres in SW Section 11-9s-8w. Consideration was $200 per acre cash bonus and $200 out of the first oil and one twenty fourth overriding royalty. Directly across the river from the discovery well, the operators leased 15 acres from Louis Lenz for $125 per acre for a one eighth interest. Union Sulphur Company also leased a 10-acre tract where Barnsdall Oil Company has a pump station, paying a cash bonus of $150 per acre and a one thirty-second royalty over and above the usual one eighths royalty. Bulk of desirable acreage not controlled by Union Sulphur Company is held by Fohs Oil Company.

New Production Found In Victoria County

San Antonio, Texas.—Another producing district was added in Victoria County during the week by the completion of The Texas Company's Jess Midgett 1 for a large gasser in a sand just above 2847 feet. The well drilled to 5790 feet, ran an electric formation testing device and plugged back to 2847 feet. On drill stem test, it rocked up 475 pounds pressure.

The well is located north 35 degrees west 1000 feet and south 55 degrees west of the southeast corner of the Jess Midgett tract in T&NO Survey No. 14, near the town of Stratton and at the DeWitt County line.

The Texas Company owns a large block in this immediate district and will drill another well shortly.

Work Underway on Calcasieu Blocks

Lake Charles, La.—Humble Oil & Refining Company has made location for Industrial Lumber Company 1-B, SE Section 27-8s-12w, six miles northeast of Starks and seven miles northwest of Edgerly, in Calcasieu Parish. This operation is in connection with development heretofore described as the hottest in South Louisiana, involving activity on the part of Humble Oil & Refining Company and Gulf Refining Company of Louisiana in Calcasieu and Bureaugard Parishes.

Gulf Refining Company has lease on 18,000 acres owned by Lutcher-Moore Lumber Company and has agreed to drill a well on each of four blocks. One of

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HOUSTON, TEXAS

these is under way—Lutcher-Moore A-1, SE Section 25-6s-12w, last reported drilling sand at 3980 feet. Gulf Refining Company's block in T-8s-R-12w and adjoining Humble Oil & Refining Company's block is scheduled for the next test.

The two companies have been working the area for the past six months with geophysical instruments, exchanging data.

Second Roanoke Well Makes Gas Producer

Lake Charles, La.—The second completion was recorded in the new Roanoke field of Jefferson Davis Parish when Humble Oil & Refining Company's Kratzer 1, Section 11-9s-4w, came in making 4,200,000 feet of gas daily.

Kratzer 1 was drilled to 8830 feet after the sand was topped at 8814 feet.

Shell Petroleum Corporation's Jarnigan 1, 660 feet due east of the discovery well and in Section 12-9s-4w, was conditioning mud at 8800 feet after coring from 8766 to 8775 feet. Several of the cores showed oil but the last core tested salty. On a core from 8794 to 8800 feet, the operators had a four-foot recovery with the top six inches sand with no cut and the bottom three feet six inches shale with no showing.

In the Gueydan field, Vermilion Parish, Pure Oil Company's Alliance Trust Company 1, Section 33-11s-1w, was coring below 9223 feet at the end of the week. On a core from 9216 to 9218 feet this test only showed sand and shale. This is the deepest drilling well on the Louisiana Gulf Coast. The test has had several good showings of oil down to the bottom of the hole.

Louisiana Coast Adds 13 Small Oil Wells

Lake Charles, La.—The Louisiana Coastal area registered 18 completions during the past week with 13 of these oil wells with a combined initial production of 8516 barrels daily. Five failures were reported. Woodley Petroleum Company's Daigle 1, 12 miles northwest of Bosco, in Section 24-7s-1e, Acadia Parish, was abandoned at 8415 feet. The geological markers on the test showed to be running high as compared to others drilled in that territory. Discorbis was encountered at 6860 feet, Heterostegina 7133 to 7145 feet and the Marginulina at 7506 feet. Elevation is 54 feet.

Gulf Refining Company's Wilson Cochran 7, Section 4-6s-5e, Port Barre, St. Landry Parish, was completed for 350 barrels per day from 3509 feet after showing salt water above and below the producing depth. A drill stem test was made at 3211 feet and the well showed 22 fourbles of salt water. An electrical logging device showed a salt water sand from 3276 to 3293 feet and on a drill stem test from that depth the well made salt water. The operators have made location for Wilson Cochran 8, 1800 feet south and 153 feet east of the northeast corner of Section 4-6s-5e.

The two largest producers for the week were The Texas Company's State Calliou 12, 500 feet west of State Calliou 10, Calliou Island, Terrebonne Parish, which came in at the rate of 1937 barrels of 33.9 gravity oil per day from 4056 feet, and the Prince Oil Company's Darame & Nickle 3, Section 26-21s-22e in the Leesville field of La Fourche Parish. The well made 1930 barrels daily through a three eighths-inch choke from 3900 feet.

Completions along the Louisiana Gulf Coast during the past week were as follows:

Company, Well and Location	Init. Prod. Bbls.	Depth
BOSCO—		
Superior Oil Co., W. V. M. Larcade 1	343	7761
EAST HACKBERRY—		
Calcasieu Oil Co., Henzen 2, (wo)	1279	5995
CAILLOU ISLAND—		
Texas Co., State Caillou Island 12	1937	4056
HACKBERRY—		
The Texas Co., State E. Hackberry 12	1320	5823
JENNINGS—		
Abshier-Boyard Oil Co., Clements 1 (wo)	193	1875
LAKE BARRE—		
The Texas Co., State Lake Pelto 11	*	3946
Whetstone & Co., Buckley 1	*	2700
LEESVILLE—		
Prince Oil Co., Dareme & Nickle 3	1930	3900
LOCKPORT—		
Magnolia Pet. Co., Miller (wo)	65	4380
Union Sulphur Co., Farquhar 1	75	6715
IOWA—		
Shell Pet. Corp., Stafford 5	66	6909
PORT BARRE—		
Gulf Refining Co., Wilson Cochran 7	350	3509
The Texas Co., Botany Bay 24	600	3159
VINTON—		
Gulf Refining Co., G. N. G. 68, (wo)	30	3094
Trio Oil Co., Grey 2	328	3607
ACADIA PARISH—		
Woodley Pet. Co., Daigle 1 c ne se 24-7s-1e	*	8415
AVOYILLES PARISH—		
Hass & Stokes, Haas 1	*	50
VERNON PARISH—		
Robert K. Williams, Llano Del Rio 2, 7-1n-9w	*	lcn.

*Failures; †Junked; ‡Million cu. ft. gas.

Rodessa

Shreveport, La.—Extension of the Rodessa gas field in Caddo Parish a half mile northeast will be determined with the outcome of United Gas Public Service Company's N. Christian 1, SE SE 23-23n-16w, which last week had drilled in and was making hole at 5723 feet. This test is going for the 5800-foot stratum of the oolitic lime which has been found more productive than the 5500-5600 foot level in that formation in Rodessa. This field yields a heavily saturated gas.

There are 16 gassers in this field.

New Louisiana Drilling Involves Lease Blocking

Shreveport, La.—Eight first reports were added to North Louisiana drilling last week, besides the assembling of several other blocks for early tests.

In Bossier Parish, W. A. Kirklin, Trustee, has assembled a 4000-acre block and is rigging for Garrett & McKellar 1, 330 feet north and west SEC NW NW 3-21n-13w. Dickinson & Pearce are assembling a 3000-acre block east of the shallow Bellevue field, Bossier Parish, for a test in Section 6-19n-10w, the first of a series of shallow tests with a spudding machine. Bellevue produces from the 300-400 foot level in Nacatoch.

In Claiborne Parish, about four miles northeast of the old Homer field, Bundy et al of Tulsa, Oklahoma, have made location for King 1, Section 12-21n-7w, on a 4500-acre block.

Two new Nacatoch sand gas tests will be drilled in the Blanchard gas field, Caddo Parish. M. Segal et al have spudded P. A. Sharpe 1, NW NW 11-18n-16w, and The Texas Company is offsetting a 900-foot gas producer with W. E. Noel Fee 5, SWC NE NW 4-18n-16w.

Circle W and Windsor Oil Company of Houston, Texas, have spudded Jenkins 1, NW NW 14-12n-11w, Red River Parish, Naborton district, and are drilling below 1200 feet. In the same area, J. S. Tuffree et al are rigging T. A. Wilkinson 1, NE NE 11-12n-11w.

Two wildcat blocks have been assembled in Webster Parish. Howard Pries of Lake Charles, Louisiana, plans a possible Woodbine test on a 3000-acre block centering in Section 15-18n-10w, and M. J. Kissick, Trustee, has a 3000-acre block centering in Section 11-21n-9w.

In Winn Parish, Red River Refining Company, which is using a portable rig to drill a series of shallow tests, made location for its third operation on the block, Tremont Lumber Company 3, SE SE 26-11n-1w.

In Tensas Parish, Northeast Louisiana, H. B. Schumacher, Trustee, is rigging up to deepen Curry 1, NW NW 39-11n-12e, from 3750 feet. Eight-inch casing was set in the old hole at 1830 feet.

Pine Island Wells Test Acid Treatment

Shreveport, La.—Use of chemicals in five wells in the chalk horizon of the Pine Island field, Caddo Parish, has been completed by Stanolind Oil & Gas Company, which plans to treat 12 wells in this manner as an experiment of the effect of chemicals in the shallow chalk horizon of that field.

Converse Gas Producer Changes to Oil Well

Shreveport, La. — Seven completions were reported in North Louisiana last week, including two small oil wells both in the shallow Converse field.

An offset to a two-mile north extension of the Converse field, George L. Pace's DeSoto Corporation 1, completed as one million-foot gasser several months ago at 1943 feet, has ceased to make gas and is now producing 15 barrels of oil daily at that depth. The other Converse well, completed making 40 barrels of oil, later is reported to have gone almost entirely to water.

An interesting wildcat in Union Parish was abandoned as a dry hole at 3413 feet. This test had a small gas show in red beds at 2945 feet; elevation was 193 feet. This test logged base of Annona chalk and top of the Meekin sand at 2554 feet. The test was drilled by Leavell & Lawson of Oklahoma City.

Company, Well and Location	Init. Prod. Bbls.	Depth
CADDO PARISH—		
Bayou State Oil Corp., Connell 1, sw sw 15-21n-14w	*	964
CADDO PARISH (Blanchard)—		
Texas Co., W. E. Noel Fee 4, sw ne 4-18n-16w	¶2	915
CALDWELL PARISH—		
C. C. Davis, La. Central Lbr. Co. 1, sw sw 14-11n-3e	*	1850
SABINE PARISH (Converse)—		
Geo. L. Pace, DeSoto Corp. 1, ne se 27-10n-13w (second completion)	15	1943
Gerhig Oil Co., A. J. Burkett 3, se se 9-9n-13w	40	2041
SABINE PARISH (Zwolle)—		
Tarver & Bauer, Barthold 2, nw ne 35-8n-12w	*	2604
UNION PARISH—		
Leavell & Lawson, J. L. Gunter 1, sw sw 14-23n-3w	*	3413

*Failures; †Junked; ¶Million cu. ft. gas.

Louisiana Permits

Shreveport, La.—Eighteen drilling permits were issued last week by the Louisiana Conservation Commission. Seven permits were for north Louisiana and eleven for south Louisiana. The north Louisiana permits were divided among the following parishes: Bossier, one; Caddo, one; East Carroll, one; LaSalle, one; Red River, two; and Sabine, one.

The south Louisiana permits were divided among the following parishes: Acadia, one; Calcasieu, one; Iberia, three; La Fourche, two; Plaquemines, two, and St. Landry, two.

Tennessee Test Starting New Hole

Memphis, Tenn.—Having failed to recover hung drill pipe in Jarrett 1, Haywood County, Tennesssee, E. R. Henderson has junked hole at total depth of 2213 feet and skidded 150 feet north for another hole, Jarrett 2. Tennessee is unsectionized. The tests are about five miles from the town of Brownwood.

The gas show encountered in Henderson's test which was on a 38,000-acre block has aroused considerable interest in southeast Tennessee. M. J. Kissick of Shreveport has assembled a 14,000-acre block six miles south of Stanton, Fayette County, Tennessee, and is moving in a rig from Sabine Parish, Louisiana, for a contemplated 3000-foot test. This block joins Henderson's holdings on the west.

Schaffer Oil Company of Oklahoma has assembled a 20,000-acre block several miles northeast of Summerville, county seat of Fayette County.

Phillips Petroleum Company has had a geologist in this section since the gas show in Henderson's test.

Four New Tests Get Underway in Arkansas

El Dorado, Ark.—Arkansas had four first reports last week. In the Garland City field, Miller County, J. T. Parks moved in materials for H. E. Beck 2, SEc SW SW 34-15-26, offsetting a 300-barrel pumper that extended production a quarter-mile east. The first test on this lease was drilled by Thorn Tree Oil Company.

In LaFayette County, Bodcau district, W. H. Harvey, who several months ago took over a number of abandoned tests in that field which at one time had several small producers with a combined yield of 100 barrels daily, erected derrick for A. M. Allen 2, SEc SW 18-19-24, located 150 feet northeast of Arkansas Fuel Oil Company's A. M. Allen 1 in the same section.

In Woodruff County, L. P. Lively is rigging for a wildcat test, P. Perkins 1, 330 feet north and east SWc SE SE 5-5n-2w.

In the Champagnolle field, Union County, Short & Hayes are rigging J. W. Taylor 1, 450 feet east and 330 feet south NWc NW SE 10-17-14.

Garland City Extended By Arkansas' Lone Well

El Dorado, Ark.—The producing area of the Garland City field, Miller County, was extended a quarter-mile east with a 300-barrel pumper last week, the twentieth producer of the field.

A wildcat abandonment in Bradley County was Arkansas' only other completion last week.

Company, Well and Location	Init. Prod. Bbls.	Depth
BRADLEY COUNTY—		
Seton Oil Prod. Co., Inc., C. H. Murphy et al 1, ne se 34-15-10	*	3514
MILLER COUNTY (Garland City)—		
Jno. Wrather, H. E. Beck 1, sw se 34-15-26	300	2931

*Failures; †Junked; ¶Million cu. ft. gas.

Midland County Wildcat Showing for New Field

Mt. Pleasant, Mich.—Atha Oil Company's Moran 1, Midland County wildcat test, 13n-1e, Section 23, topped Dundee lime at 3454 feet and bottomed at 3481 feet with 1900 feet of oil showing in the casing. The test indicates a new pool five miles east of the Porter township Dundee pool, although previously drilled wildcats in Mt. Haley township, where the Atha test is located, appear to define the production horizon to a comparatively small area.

Operators plan to put the well to a thorough test this week before deepening or acid treating. Structurally, it is reported lower than some of the abandoned Dundee tests in the same township.

Mammoth Petroleum Corporation's Thomas 1, Montcalm County, Home township, Section 11, will be drilled deeper after plugging back from 3504 feet to 3503 and apparently plugging of an oil and gas show at that depth, believed Monroe lime production. Water showings in the formation which resulted in plugging back are now believed coming in from leaking five-inch casing and not from bottom hole.

McClanahan Oil Company's Sweeny 1, Isabella County, Denver township, Sec-

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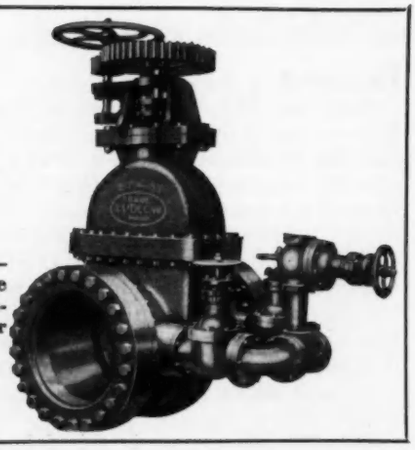

tion 33, was completed for an estimated 100 barrels a day in the Dundee to further establish a connecting Dundee structure between the old Leaton and Chippewa pools.

Completions for the week follow:

Company, Well and Location	Init. Prod. Bbls.	Depth
MIDLAND COUNTY—		
Northern Oil Co., Carter 4, 13n-1w, sw ne sw-18	625	3417
Branigar-Reasor, Sias 2, 14n-2w, ne nw se-8	*	3610
ISABELLA COUNTY—		
McClanahan Oil Co., Sweeny 1, 15n-3w, ne nw ne-33	125	3626
Michigan Cities, Leuder-Cook 1, 14n-6w, c-sw nw-11	¶1	1350
Bundy Hills Co., Russell 1, 14n-6w, nw ne ne-6	*	1485
D. F. Jones, Youmans 1, 15n-6w, c-se-nw-32	*	1405
OGEMAW COUNTY—		
M. J. Ingold, Stevens 1, 22n-1e, se ne-24	45	2775
SAGINAW COUNTY—		
Smith Pet. Co., Soule 1, 10n-6e, nw se se-29	6	1525

*Failures; †Junked; ¶Million cu. ft. gas.

Michigan Proration Order Revised

Mt. Pleasant, Mich.—An earlier order for a two percent proration schedule with a 70-barrel-per-well exemption for October was revoked September 8 by the state proration committee and a new order fixing the rate at five percent and the exemption at 50 barrels placed in effect.

Chairman James C. Graves in announcing the order said that the "2-70" ruling was instituted to take care of heavy under runs that had accumulated but that it did not work. He also pointed out that several months ago the committee had passed a ruling that under no circumstance would the rate be cut below five percent. The new ruling is effective at once.

The state's potential productions announced by the committee dropped in October to 177,075 barrels a day from 179,355 barrels per day, while there was an increase from 948 to 952 of the number of wells on production.

Potential production by pools and runs for October as compared to September follow:

POOL	No. Wells Sept.	No. Wells Oct.	POTENTIAL Sept.	POTENTIAL Oct.	RUNS Sept.	RUNS Oct.
Porter	248	262	142,098	164,600	22,938	21,932
Yost	14	14	3,382	3,657	872	652
Greendale	310	306	4,107	3,704	4,107	3,704
Vernon	51	51	2,513	2,569	2,513	2,569
Leaton	27	27	581	620	581	620
Montcalm	4	4	1,863	815	503	380
Ogemaw	17	19	343	443	343	443
Saginaw	109	104	96	94	96	94
Lapeer	3	3	30	30	30	30
Oceana	14	15	56	139	56	139
Muskegon	151	147	297	404	297	404
Totals	948	952	155,366	177,075	32,336	30,967

Brea Canyon Gets New Well After 12-Year Wait

Los Angeles.—A new completion for Brea Canyon for the first time in 12 years was reported last week when General Petroleum Corporation's Tonner 8-A came in at 3700 feet for 1048 barrels of 25 gravity oil, cutting nine percent.

The hole had been drilled to 4070 feet and plugged to 3700 feet. Liner was run to 3699 feet and included 1708 feet of perforated, cemented through perforations at 1991 feet.

General Petroleum has rig up for Tonner 15.

New California Operations

Los Angeles.—Of the 21 notices to drill new wells in California filed the week ending September 29, four were for the Mesa field, in Santa Barbara County, and five will be drilled in Mountain View field in Kern County. One new well is starting at Belridge and another at Edison. Two of the new wells to be started are wildcats.

Long Beach Still Going Strong After 14 Years

Los Angeles.—Although the Long Beach field in California is 14 years old and had produced slightly more than 502,000,000 barrels of oil to January 1, the old field is still very active with 32 strings of tools busy October 1. Of course, this does not mean that 32 new wells are drilling, but does mean there is activity at that number of holes and a few of them are new holes drilling from the start.

In addition to the activity mentioned, there are seven new rigs in the field and rotary tools are rigging up to start drilling at two locations. During August of this year, 16 old wells were recompleted or reconditioned, and one new well was drilled to completion for a producer.

There are 636 separate and distinct leases in the Long Beach field and 1300 acres have been proven for production. The average depth of the wells now on production is close to 5500 feet.

The old field furnished a total production of about 75,000 barrels during the year 1920 and has been very much in the limelight since that time.

In 1930, the field produced 36,599,686 barrels and dropped to 30,166,409 barrels in 1931. Total production in 1932 was 27,435,553 barrels and again declined to 24,798,242 barrels in 1933. But as oil fields go, a drop of only 12,000,000 barrels a year in four years is not so bad, especially under curtailment, etc. Fifty new wells were completed in 1933 when the field was 13 years old.

As of July, there were 1113 wells on production and 95 wells shut in. The producers were credited with a daily per well potential of 94.3 barrels, while the idle producers had an estimated potential of 56.3 barrels.

The production allowable for the wells on production in July was 61 percent of the potential.

California Shipments

Los Angeles.—Tanker shipments of all petroleum products from California in August reached a total of 5,661,947 barrels. Of this total 2,309,841 barrels was fuel oil and 1,523,707 barrels was gasoline.

Slightly better than half of the fuel oil went to Atlantic domestic ports and 730,143 barrels of the gasoline moved to the same area. Of the total movement of all products, Pacific foreign ports drew 2,865,317 barrels.

Package goods shipments totaled 326,384 barrels, of which 155,727 barrels was gasoline and 93,770 barrels was asphalt. The kerosene shipments totaled 13,784 barrels. These figures were compiled by the West Coast office of the Bureau of Mines.

Los Angeles.—During August, California reported 50 operating refineries with a combined reported capacity of 758,435 barrels daily throughput. During the same period 91 natural gasoline plants were active with a daily capacity of 2,295,337,000 cubic feet of gas. Production of natural gasoline was 44,135,176 gallons during August.

Total of 791,800 gallons of liquefied petroleum gas was produced that month.

Kettleman Deep Holes

Los Angeles. — Kettleman North Dome Association's No. 56-8Q in Section 8-22-18, North Dome edge well at Kettleman Hills, total depth 10,154 feet, has cemented string of 9⅝-inch at 8304 feet and is waiting for cement to set. This hole has 13⅜-inch at 6847 feet.

The other deep hole at Kettleman Hills is Union Oil Company's North Kettleman Oil & Gas Company well,

which is bottomed at 10,944 feet, is progressing on the sidetracking job and the bit has reached 8040 feet in the new hole along the side of the frozen tubing.

Los Angeles.—Standard Oil Company is preparing to drill a wildcat in the Semitropic area of Kern County in Section 8-27-23. Shell Oil Company drilled Williams 1 in this area and a number of good showings were reported. Considerable geophysical work has been done in this area and for this reason the new wildcat will be watched with unusual interest.

Los Angeles.—Standard Oil Company is drilling two new wells in the old West Coyote field and has rig up for the third new hole. There has been very little activity in this field for several years.

Los Angeles.—Wilshire Annex Oil Company's Potrero 2, deep test for Potrero at 7985 feet, is washing over stuck pipe, bottom of which is at 6250 feet. This hole had a lot of gas pressure and owners have great hopes of completing a producer in a new and deep zone.

Kettleman Completion Is Disappointment

Los Angeles.—The lone completion the past week at Kettleman Hills in California was a disappointment, since its initial production was given at 340 barrels of 35.1 gravity oil and 36 barrels of water. The well was drilled to 8435 feet and then plugged to 8097 feet. The test is located on the edge of the North Dome, this largely explaining its low production. The gas output was 2,017,000 cubic feet.

A new well at Mountain View was good for 1900 barrels of 31 gravity oil at 5565 feet. The gas output was 3,000,000 feet. Another new producer was completed in the Mesa field in Santa Barbara County for 1200 barrels of oil at 2049 feet. The pressure was 150 pounds on the tubing and 500 pounds on the casing.

Nine completions were reported for California for the week.

Company, Well and Location	Init. Prod. Bbls.	Depth
KETTLEMAN HILLS—		
Kettleman No. Dome Assn., 21-32J..	340	8097
MOUNTAIN VIEW—		
Mohawk Pet. Co., McKeehan 2	1900	5565
Sovereign Oil Co., S. J. D. 2	350	6203
MT. POSO—		
Shell Oil Co., Vedder-Rall 5.....	665	1890
MESA—		
Trans-Oceanic Oil Co., No. 1.....1200		2049
BREA CANYON—		
General Pet. Corp., Tonner 8A 1000		4070
LONG BEACH—		
Ladden Oil Co., No. 1	275	4780
Russel-Kauffman, No. 1	350	4150
SANTA FE SPRINGS—		
Union Oil Co., Bell 65	40	3760

*Failures; †Junked; ¶Million cu. ft. gas.

Cooper Extension Test Craters, Gas Burning

Hobbs, New Mexico.—Burning gas escaping from craters formed around Humble Oil & Refining Company's Coates 1, two miles north of production in the Cooper field, Lea County, was hindering efforts of a large corps of workmen in placing the well under control late last week. This outpost test blew out with an estimated flow of 50,000,000 cubic feet of dry gas while drilling with rotary below 3300 feet, and when special equipment employed by the contractor for such an emergency permitted the well to be shut in, the gas broke through to the surface some distance from the derrick.

Numerous streams of water played upon and around the derrick had prevented the fire from reaching the drilling equipment. An unsuccessful effort was made to pump cement between the surface pipe and 9⅝-inch casing, which had previously been cemented at 2979 feet, or 16 feet above the top of the brown lime section. Shallow holes have been drilled at intervals near the rig as a means of diverting the migratory gas from the scene of operations.

A connecting link for the Cooper area with the North Jal field was considered established October 10, when The Texas Company's I. B. Ogg 1, C SW NE 35-24s-36e, an intermediate test along the 3½-mile interval, flowed natural at the rate of 600 barrels daily from 3523 feet, or 245 feet below sea level. This well previously showed for a similar size producer on drill stem test at 3480-3523 feet. Should later development substantiate this probable linking of the two areas their combined length will exceed 7½ miles in a general north and south direction, with a width now averaging under one mile. Ogg 1 logged top of brown lime at 2880 feet, or 398 feet above sea level, and all markers, including the producing horizon correlate favorably with nearest wells in both areas.

Increased sulphur water was credited to Humble Oil & Refining Company's A. E. Thomas 1, C SW SE 23-24s-36e, first disappointment for the Cooper field, in drilling to 3602 feet, or 262 feet below sea level. This test was reported last week as having apparently missed the oil zone, else carried gas in the lime section due to yield oil because of being situated at a high point on the structure, but not the highest. It proved capable of 13,000,000 cubic feet of gas on drill stem test at 3437-81 feet; tested dry at 3505-20 feet, then showed sulphur water on series of drill stem tests made below 3520 feet. Reports indicate that the company will plug back to 3592 feet and try for an oil producer in lime section at 3545-92 feet, otherwise it will be completed as a gasser.

Two tests in process of completion on Phillips Petroleum Company and Pure Oil Company's C. D. Woolworth lease, which has four wells on production, includes a west offset to the above disappointment. Woolworth 7, C SE SW 23-24s-36e, logged the top of the brown lime at 2767 feet, or 30 feet structurally higher than Thomas 1, and was trying to cleanup fishing job to make a drill stem test at 3500 feet. The formation tester and 18 joints of drill pipe were lost in the hole. Woolworth 5, C NE NE 27-24s-36e, was rated good for 206 barrels of oil per hour and 2,500,000 cubic feet of gas daily when formation tester was used in lime section at 3485-3504 feet, including a big well in the making. Top of brown lime was logged at 3007 feet, or 326 feet above sea level. Comparison of this marker with wells referred to above reveals a steep west dip in the structure.

Billings, Mont.—Ohio Oil Company's Agnes Maddox 14, NW NW Section 10-7s-21e, in the Dry Creek field, Carbon County, Southern Montana, is coring in the Rainbow shale between the Dakota and Lakota at 6002 feet. This should be an early completion.

Mountain States Completions

MONTANA

Company, Well and Location	Init. Prod. Bbls.	Depth
GLACIER COUNTY (Cut Bank Field)—		
W. M. Fulton, Haggerty 2, nw nw 15-34n-6w	40	3054
Texas Co., Hesler 1, ne nw 20-35n-5w	25	2987
Montana Power Gas Co., DeZort Unit 1, s½s½ 23-35n-5w	75	2872

WYOMING

PARK COUNTY (Oregon Basin Field)—		
Paul Stock, Government 2, sw se ne 29-52n-100w 3000		3589

COLORADO

ARCHULETA COUNTY—		
Navajo Oil Co., Crowley 1, sw ne 11-32n-1e	*	390
EL PASO COUNTY—		
Colorado Springs Oil & Natural Gas Co., Carson 2, nw ne ne 10-16s-66w	*	2504
LA PLATA COUNTY—		
McGarr Petroleum Co., Pinon Mesa 1, se ne ne 34-33n-12w.....	*	....
ADD N. MEX COMPS.		

NEW MEXICO

LEA COUNTY (Cooper Field)—		
The Texas Co., I. B. Ogg 1, c sw ne 35-24s-36e	600	3513

*Failures; †Junked; ¶Million cu. ft. gas.

Oregon Basin Well Is Largest in Four Years

Cody, Wyo.—The largest completion to date in the Oregon Basin field, 18 miles southeast of here, and the largest oil well completion in Wyoming during the past four years, was made this week when Paul Stock's Government 2 came in for 3000 barrels initial.

The well located at center SE SE NE Section 29-51n-100w, came in as surprise as it was believed to be located on a saddle, unfavorable for oil production, between the north and south "highs" of the structure. The well is offset by unleased government land.

Government 2 topped the Embar formation at 3500 feet and hole bottoms at 3585 feet. Paul Stock is a veteran Rocky Mountain oil operator, and is principal stockholder in Big Horn Oil & Refining Company of Billings, where he has his residence.

Two wells are drilling close to the pay in the Byron field, Big Horn County. Sidney H. Keoughan and Taylor Oil Company's Hoskins 1, SE SE Section 25-56n-97w, in the heart of the field, is coring ahead at 5275 feet feeling for the Embar. Ohio Oil Company's Byron-Union 2, SE NE Section 2-56n-97w, is drilling at 5100 feet.

On Garland Dome, adjoining the Byron field, Peter Evanoff is spudding Griffin 1, Lot 60, Section 4-55n-97w, to go to the Madison lime. This test is being drilled by Sidney H. Keoughan under operating agreement. In the same field, Garland Oil Company has erected standard derricks over Victor Cotner 1, NE SE NW Section 10-56n-98w, and over Government 2, center of the south line of NE NW Section 14-56n-98w, which spudded with machine and set 60 feet of 20-inch conductor pipe.

Kirk Oil Company's Kirk 2, SE SW SW 24-58n-98w, in the Frannie field, Park County, is drilling below 2700 feet. Dry Creek Oil Company (Val M. Kirk et al) is waiting for cement to set around six-inch casing at 1093 feet in its important semi-wildcat test, Government 2, NE SW Section 9-50n-100w, in the south fault block area of the Oregon Basin field. This test had 11,000,000 cubic feet of gas at 935 feet.

Utah-Colorado

Rock Springs, Wyo.—Mountain Fuel Supply Company's Murphy 2, SE NE 21-3n-24e, Dagget County, Northeastern Utah, is coring below the Frontier formation at 5463 feet. Objective of the test is the Dakota series, expected at around 6200 feet.

The company's Florence Wilson 4-B, CNE NW Section 23-12n-100w, on the Colorado side of the Hiawatha Dome gas field, Moffat County, is shut down at 2337 feet after plugging back to test oil show.

The Texas Company's Van Schaick 1, SW SW Section 19-21n-100w, in the same field, is drilling out plug with eight-inch set at 2100 feet. After setting 10¾-inch casing at 1510 feet, Quaintance-Hocking 1, NE SW NE Section 18-6n-86w, in the old Tow Creek field, Routt County, Colorado, is drilling at 1565 feet.

Stanolind Oil & Gas Company is drilling below 300 feet in Parkinson 14, NE SW Section 22-4n-92w, in the east end of the Iles Dome field, Moffat County, Colorado. The company this week released location for Shaw 22, NW Section 27-4n-92w, in the same field.

Acid Works in Montana

Kevin, Mont.—Acid turned another apparent dry hole into a producer this week in the Kevin-Sunburst field, Toole County. Engleking & Pfabe's Seabrook 6, CNW NE Section 30-35n-2w, treated with 500 gallons of acid at 1524 feet and produced 50 barrels initial on the pump.

Potlach Oil Company completed Fee 4, SE NE Section 21-34n-1w, for 1,500,000 cubic feet of gas daily at 1556 feet.

Texas Pacific Coal & Oil Company's Howling 11, SE NE 9-35n-2w, is a failure at 1555 feet, and is being plugged and abandoned.

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SEE OUR DESCRIPTIONS IN THE COMPOSITE CATALOG

Eastern Fields Completions

WEST VIRGINIA

Company, Well and Location	Init. Prod. Bbls.	Depth
BOONE COUNTY—		
Godfrey L. Cabot, Inc., J. Q. Dickinson 3	*	3185
Pure Oil Co., Federal Coal Co. 67	¶	2465
CABELL COUNTY—		
West Virginia Gas Co., A. Adkins 1	¶	3586
CALHOUN COUNTY—		
Jackson & Bowers, Chas. White 1	¶	1380
Eastern States Gas Co., Albert Wilson 2	¶	1695
CALHOUN COUNTY—		
Ohio Valley Gas Co., N. L. Norman 1	¶	2521
A. Rothwell & Co., E. E. Marshall 1	*	1835
Carroll & Hamilton, C. & R. Kotts 1	¶	1925
F. F. McIntosh, Mary E. Hays 5	¶	1975
CLAY COUNTY—		
South Penn Oil Co., O. D. Stockley 108	10	....
DODDRIDGE COUNTY—		
Hughes River O&G, C. P. Broadwater 1	5	1901
GILMER COUNTY—		
Hope Const. & R. Co., A. H. Blackshere 1	300	2140
E. D. Norman & Co., Hulda Moore 1	¶	1867
KANAWHA COUNTY—		
Virginia Gas Corp., Sophronia Young 1	5	....
KANAWHA COUNTY—		
Godfrey L. Cabot, Inc., A. D. Huntington 45	¶	2825
A. D. Huntington 46	¶	2105
LINCOLN COUNTY—		
David Gas Co., T. W. Dolan 1	¶	2173
LINCOLN COUNTY—		
Kanawha G&U Co., W. W. Ray 125	¶	3196
PLEASANTS COUNTY—		
W. C. Patterson & Co., Roland Dye 2	¶	....
RITCHIE COUNTY—		
Cottrill & Co., M. S. Riggs 3	100	1854
Alvin McCullough & Co., Haymond Hrs. 1	*	1900
Lucky Strike Oil Co., A. R. Daugherty 1	5	2064
ROANE COUNTY—		
Guy Bogges & Co., O. M. Young 1	¶	1997
ROANE COUNTY—		
United FG Co., S. C. & Lucy Ross 1	15	1670
Oil City Trust Co., B. C. Tucker 18	4	....
TYLER COUNTY—		
Gale Oil Co., Neuenschwander 10	4	....
Hope Const & R Co., J. B. McCoy 1	*	1832
WAYNE COUNTY—		
Edward O&G Co., Albert Ronk 2	5	....
WETZEL COUNTY—		
George N. Yoho & Co., J. W. Monroe 1	¶	2829
C. B. Lewis & Co., John Blatt 1	¶	1805
WIRT COUNTY—		
C. S. Benedich & Co., Thomas Lewis Hrs. 68	¶	2554
Godfrey L. Cabot, Inc., Mary Dickinson 2	¶	3017
Pond Fork O&G Co., Cole & Crane 18	¶	2309
R. C. Waggner & Co., J. W. Bunner 1	¶	1560
WOOD COUNTY—		
Burnt Hill Oil Co., B. F. Mays 1	*	....

KENTUCKY

Company, Well and Location	Init. Prod. Bbls.	Depth
OHIO COUNTY—		
Cumberland Pet. Co., Rolla Richards 1	50	....
Rolla Richards 2	75	....
Rolla Richards 3	100	....
Rolla Richards 4	100	....
Rolla Richards 5	85	....
Rolla Richards 6	60	....
Rolla Richards 7	55	....
Rolla Richards 8	100	....
W. E. Hupp & Co., Luther Noel 1	*	....
L. & N. R.R. 3	45	....
L. & N. R.R. 2	100	....
Vickers & Co., Sally Jones 3	125	....
Sally Jones 4	140	....
Sally Jones 5	85	....
The Petroleum Co., Jones 3	130	....
Jones 4	140	....
Jones 2	75	....
A. Carpenter, Petit 1	80	....
Mark-Bell & Co., Chas. Wedding 2	100	....
Chas. Wedding 3	45	....
Miller & Co., Jasper Roberts 2	70	....
Kentucky Prod. Co., A. Mills 1	*	....
J. C. Miller & Co., E. Templeton 1	*	....
Duffin & Co., Cynthian Wedding 1	*	....
Mark-Bell & Co., A. Miller 1	*	....
Mecca O&G Co., W. Smith 3	*	....
J. C. Miller & Co., S. Winkle 1	*	....
Snowden-McSweeney Co., G. E. Fuqua 11	*	....
Joseph B. Mayer, Jess Stewart 7	50	....
W. E. Hupp & Co., J. W. O'Dell 21	80	....
J. W. O'Dell 22	60	....
J. W. O'Dell 23	100	....
J. W. O'Dell 24	30	....
J. W. O'Dell 25	5	....
J. W. O'Dell 26	2	....
Jos. B. Mayer, J. W. Matthews 7	170	....
Joseph M. Mayer, James Newton 7	*	....
Snowden-McSweeney, J. W. O'Dell 3	60	....
J. W. O'Dell 4	75	....

CENTRAL OHIO

Company, Well and Location	Init. Prod. Bbls.	Depth
ASHLAND COUNTY—		
First N B of Newark, Deviney Hrs. 7	2	....
McClure 3	2	....
C. D. Moore, G. Black 5	2	....
Robinson & Co., A. J. McClure 3	6	620
ATHENS COUNTY—		
Ohio FG Co., S. E. Searle 1	*	1286
BELMONT COUNTY—		
O. K. Oil Co., School Land 3	15	1892
Peters & Patterson, Lorain 1	¶	1850
Richland Dev. Assn., J. R. Lackey 6	¶	1305
Union G&O, W. Krotly 1	*	....
COSHOCTON COUNTY—		
Preston Oil Co., D. S. Snyder 3	25	3306
GUERNSEY COUNTY—		
Ohio FG Co., John Johnson 5	¶	1515
Oxford O&G Co., T & R Shearer 6	7	3174
George Jewell, C. Weaver 1	32	3633
Wilber Keith, R. Foraker 2	¶	1534
HOLMES COUNTY—		
Ohio FG Co., W. C. Uhl 1	*	2752
HOLMES COUNTY—		
Ohio FG Co., L. Houdenschild 1	¶	3104
HURON COUNTY—		
J. E. Ringler, H. Southerland 1	¶	390
JEFFERSON COUNTY—		
E. C. Collins & Co., Steubenville 3	*	1570
C. S. Kelley & Co., E. E. Baxter 7	12	740
KNOX COUNTY—		
Lacknett & Co., G. Lepley 1	¶	769
Preston Oil Co., Beckley 2	¶	3265
KNOX COUNTY—		
Ohio FG Co., G. Beckley 2	¶	3179
LICKING COUNTY—		
Blue Rock Oil Co., S. Mossholder 9	40	3015
Blue Rock O&G Co., W. Hoyt 1	12	....
Wehrley Gas Co., Caldwell 1	*	3118
Hugh Ridgeway & Co., A. Hoyt 4	7	715
LORAIN COUNTY—		
Wittmer O&G Co., J. C. Aldrick 1	*	2493
MEDINA COUNTY—		
E. R. Edson Sons Co., Miller 53	*	491
MEIGS COUNTY—		
Barton & Utsinger, A. Sexton 1	¶	835
MEIGS COUNTY—		
P.&G. O.&G. Co., E. M. Winters 1	*	2006
A. N. Bengel, G. Burch 1	¶	2007
Barton & Utsinger, A. Saxton 1	¶	850
Ohio FG Co., A. Lovett 1	¶	1948
F. J. Hysell 1	¶	848
Meigs Dev. Co., E. Mosier 2	¶	1997
MUSKINGUM COUNTY—		
Ohio FG Co., A. Mattingley 1	¶	3352
MUSKINGUM COUNTY—		
Pure Oil Co., F. N. Norman 1	20	4068
E. Shepard 2	80	3212
SCIOTO COUNTY—		
Ronshausen & Co., Vern C. Purdy 1	¶	335
STARK COUNTY—		
McFarland & Co., C. Schumacher 1	¶	4561
Brendel Prod. Co., I.&E. Markley 3	¶	4535
East Ohio Gas Co., C. Pontius 3	¶	4561
TUSCARAWAS COUNTY—		
Frey & Co., F. Brick 1	¶	876
Gordon Oil Co., Shearer 6	10	....
VINTON COUNTY—		
Ohio FG Co., H. C. Remy 1	¶	2800
Co-Operative Oil Co., Garfield Brooks 6	*	....
WAYNE COUNTY—		
Ohio FG Co., L. Keen 1	¶	2870
Harmon & George, H. Hagerman 3	25	865
David Shafer, E. Betz 1	¶	....

NORTHWESTERN OHIO

Company, Well and Location	Init. Prod. Bbls.	Depth
ALLEN COUNTY—		
C. A. & F. J. Peavey, C. E. Baldwin 2	20	....
HANCOCK COUNTY—		
S. S. Sweet, H. P. Smith 17	1	....
LUCAS COUNTY—		
John Doblinger, Sol Betts 2	7	....
SANDUSKY COUNTY—		
Perpetiual Rights Corp., Bowe 1	4	....
SENECA COUNTY—		
Tiffin Ind. Gas, Shawhan 2	¶	....
WYANDOT COUNTY—		
Plank O&G Co., O. Berg 2	¶	1368
Cherokee O&G Co., J. Smalley 1	*	1371

SOUTHEASTERN OHIO

Company, Well and Location	Init. Prod. Bbls.	Depth
MORGAN COUNTY—		
D. T. Orndoff, B. Hopkins 32	¶	1428
Mosier & Co., Chas. Yarnell 29	2	588
MONROE COUNTY—		
Wolf Penn O&G Co., J. F. Bishop 1	¶	1216
J. C. Christy & Co., J. H. Shafer 3	40	1386
NOBLE COUNTY—		
R. L. Smithberger, Smithberger 31	1	530
WASHINGTON COUNTY—		
Wietherman Oil Co., P. D. Howiler 11	4	1704
Otto Heldman & Co., O. Heldman 5	2	1915
Twin Oak Oil Co., C. Lauer 15	2	283
George Montgomery, W. Kinsey 3	1	305
R. O. Wooster, A. Becker 6	1	298

PENNSYLVANIA

Company, Well and Location	Init. Prod. Bbls.	Depth
BEAVER COUNTY—		
Harbison & Co., Means Hrs. 1	*	1500
GREENE COUNTY—		
Equitable Gas Co., C. F. Stoneking 1	¶	3905
J. B. Orndoff, W. H. Scott 1	¶	3422
WASHINGTON COUNTY—		
South Penn Oil Co., F. H. Wade 1	1	....
New Oil & Gas Co., J. S. Wilson 1	5	1239
Duquensnee Gas Co., J. Day 1	40	3075

*Failures; †Junked; ¶Million cu. ft. gas.

Zero Weather No Stop To Cut Bank Work

Cut Bank, Mont.—Despite a heavy snow and sub-zero weather in Glacier County, Northern Montana, the Cut Bank field had one oil well completion and two tests start during the past week. The three operations were carried out by the Consolidated Gas Company which completed Ewing 2, center Lot 4, Section 34-35n-6w, for 50 barrels daily on the pump. Hole bottoms at 2963 feet. The company is spudding Tribal 1, Lot 5, Section 34-35n 6w, and is rigging up for Tribal 2, Lot 6, Section 34-35n-6w. The tests offset the prolific Texas-Antrim lease to the west.

W. M. Fulton's Haggerty 2, CNW NW Section 15-34n-6w, in the western extension area of the field on Indian land, is a near completion, drilling out plug with the seven-inch casing set at 2992 feet.

Drilling Reports on Important Wildcats

KANSAS

BARBER COUNTY—Lario et al's Whelan 1, cnw 32-31s-11w, si tankage, to retest.

BARTON COUNTY — Atlantic Oil Co.'s Vaniman 1, csw ne 15-20s-12w, dr 3633 ft. Gypsy, Atlantic & Shell's Batchman 1, csw ne 18-20s-11w, sd 3518 ft. National Refining Co.'s Ingersoll 1, cne ne 2-19s-13w, set 6-in csg 3197 ft, dr 3314 ft. Murphin & Downing's Lanterman 1, nw se 15-19s-11w, ru and sd. C. L. Price et al's Ehrlick 1, nw se 10-16s-13w, rig.

BUTLER COUNTY—Gaines et al's McKinley 1-A, ne sw 19-29s-4e, running 8-in csg 1220 ft. Bill Rex et al's DeMoss 1, ne nw 8-28s-7e, set 8-in csg 1903 ft, set 6-in csg 2150 ft, so 2200 ft, dr 2225 ft.

CLAY COUNTY—Seidel Brothers' Younker 1, cs½ se nw 21-9s-4e, set 8-in csg 1188 ft, dr 1252 ft.

COWLEY COUNTY — National Refining Co.'s Robinson 1, ne se ne 11-34s-4e, recementing 5-in csg 3105 ft, wocs. Wakefield's Weigle 1, se se 6-32s-6e, dr 2285 ft.

DICKINSON COUNTY — Dutch Oil Co.'s Phillips 1, cne nw 15-15s-1e, set 8-in csg 2300 ft, dr 2475 ft.

ELLSWORTH COUNTY—Lario Oil & Gas Co., A. Harbacek 1, sw sw nw 7-16s-10w, set 10-in csg 1578 ft, co. Ainsworth Bros.' Charvat 1, ne nw ne 33-15s-10w, rust and sd.

GEARY COUNTY—Severs et al's Meyers 1, ne nw nw 4-10s-4e, sd 1796 ft.

HARVEY COUNTY—Hollow et al's Summerfelt 1, nw ne nw 8-22s-1w, potential 247 bbls oil, comp. Wenzel et al's Schrag 1, nw se 24-22s-3w, sd 587 ft.

KINGMAN COUNTY — W. C. McBride's Wooleridge 1, nw ne 16-27s-7w, set 8-in csg 3873 ft, wocs.

McPHERSON COUNTY—Palmer & Phillips' Moddelmog 1, ne ne nw 8-21s-1w, hfw 3506 ft, td 3596 ft, D&A. Stark & Wells' Smith 1, nw nw nw 13-10s-3w, lcn. Roth, Farrout et al's Bestwater 1, se sw se 23-30s-1w, ru and sd. C. W. Lamer et al's Rolander 1, ne ne nw 8-18s-2w, rig and sd.

OSBORNE COUNTY—Carmen & Hershey's Fritz 1, cne ne 9-10s-14w, ur 12-in csg 1272 ft.

RENO COUNTY — F. H. Unruh's Joseph 1-A, se sw nw 18-25s-4e, rig. Privett Drilling Co.'s Crotts 1, ne nw ne 27-26s-10w, (owdd), set 12-in csg 1129 ft, dr 1370 ft. McBride's Popp 1, sw sw ne 32-24s-4w, set 15-in csg 248 ft, wocs.

RICE COUNTY—Deitrick et al's Fitzpatrick 1, cne ne 30-21s-8w, hfw 3555-65 ft, ur 5-in csg 3577 ft. Darby et al's Taylor 1, nw se sw 25-19s-8w, set 8-in csg 3018 ft, so and water 3185 ft, dr 3204 ft. Yingling et al's Maupin 1, nw sw sw 1-18s-8w, fsg 2620 ft. Foraker-Nickerson et al's Lyon 1, se nw 27-20s-8w, spd and sd. Langston et al's Markel 1, ne sw 1-20s-9w, set 6-in csg 2868 ft, td 2885 ft.

ROOKS COUNTY—Stearns-Streeter et al's Hoskins 1, se sw se 34-9s-16w, ru.

RUSH COUNTY—Corbett & Barbour et al's Schmidt 1, sw sw se 19-27s-16w, rust. Twin Drilling Co. et al's Rolfs 1, sw nw sw 13-17s-19w, br.

RUSSELL COUNTY — Eldorado Refining Co.'s Stratman 1, sw se se 32-14s-11w, set 10-in csg 1815 ft, dr 1860 ft. Tom Palmer et al's Herbel 1, nw sw 4-12s-11w, set 15-in csg 175 ft, set 12-in csg 474 ft, dr 485 ft.

SALINE COUNTY—Dieter et al's Herrington 1, ne nw se 3-13s-1w, rig.

SEDGWICK COUNTY — Trees Oil Co. & Derby Oil Co. et al's McMinn 1, nw sw ne 36-26s-1e, sd 3320 ft. Jones, Kirk et al's McQuillan 1, ne nw ne 21-29s-2w, fsg 3720 ft. Gypsy Oil Co. & Buell's Tammany 1, nw ne 4-29s-1w, td 3952 ft, D&A. Allison & Fitzwilliams' Struthers 1, ne sw sw 34-28s-2w, pb to 179 ft, dr 500 ft. Syndicate Oil & Gas Co. et al's Ratzlaff 1, ne nw nw 30-26s-2e, rust and sd. R. D. Lauck et al's F. A. Roy 1, ne ne sw 24-29s-1w, set 10-in csg 2069 ft, dr 2427 ft. Leo Keller et al's Russell 1, sw sw nw 16-29s-3e, cellar.

SUMNER COUNTY—Wentz & Continental's Small 1, nw sw 5-33s-4w, dr 4480 ft. Wentz et al's Horsley 1, csl sw sw sw 18-35s-1e, dr 2650 ft. Foraker et al's Hiett 1, se sw ne 34-34s-4w, spd and sd.

TREGO COUNTY — Marathon Oil Co.'s Kline 1, sw se 19-14s-24w, ur 8-in csg 4002 ft.

ABBREVIATIONS

The following abbreviations, signs, etc., are used in completions and wildcat reports in THE OIL WEEKLY.

* —*dry hole abandoned well.*	owdd —*old well drilling deeper.*
‡ —*salt water (completions).*	owpb —*old well plugging back.*
† —*junked and abandoned.*	pb —*plugged back or plugging back.*
¶ —*million feet of gas.*	r —*reaming.*
abd —*abandoned.*	rog —*rig on the ground.*
bbls —*barrels.*	rur —*rigging up rotary tools.*
br —*building rig.*	rust —*rigging up standard tools.*
b.s. —*basic sediment.*	sd —*shut down.*
csg —*casing.*	sdtr —*sidetracking.*
co —*cleaning out.*	sg —*show gas.*
dd —*drilling deeper.*	si —*shut in.*
dk —*derrick.*	so —*show oil.*
dr —*drilling.*	so & g —*show oil and gas.*
fsg —*fishing.*	spd —*spudding.*
ft —*feet.*	sr —*straight reaming.*
hfw —*hole full of water.*	sw —*salt water.*
in —*inches.*	td —*total depth.*
lcn —*location.*	ur —*underreaming.*
m —*milling.*	wih —*water in the hole.*
mim —*moving in materials.*	wo —*workover.*
mit —*moving in tools.*	wocs —*waiting on cement to set.*
mot —*milling on tools.*	wosr —*waiting on standing rig.*
n, s, e, w, —*north, south, east, west.*	
oih —*oil in hole.*	

OKLAHOMA

ATOKA COUNTY—Brookshire et al's Rowland 1, nw ne ne 18-3s-10e, sr 3610 ft. T. C. Ramler et al's William Roberts 1, sw se sw 6-2s-12e, sd 1007 ft.

BECKHAM COUNTY—Price & Watchorn's Heard 1, ne sw 17-8n-26w, water 2303 ft, sd 2312 ft. Fred Coogan et al's Shelton 1, sw sw sw 33-10n-25w, material on ground.

CADDO COUNTY—H. W. Lee et al's Stacey Ferrell 1, sw ne ne 3-6n-13w, dr 356 ft. Denver P. & R. Co.'s Noe 1, nw sw sw 34-10n-10w, fsg dr pipe.

CARTER COUNTY — Hudson & Poland's Sullivan 1, ne se 5-5s-1w, td 4511, D&A. Daphfine Oil Co.'s Hooks 1, se nw nw se 5-1s-2w, dr 2130 ft. C. P. Williams et al's Singleterry 1, se sw nw 25-2s-3e, dr 125 ft.

CHOCTAW COUNTY—J. V. Schrivner et al's Swink 1, cne se 29-6s-20e, sd 810 ft.

CLEVELAND COUNTY — Mid-Continent Oil et al's Collett 1, ne sw 35-10n-1w, set 9-in csg 5286 ft, td 5290 ft, wocs. Anderson-Kerr et al's Wilson 1, nw se 27-10n-1e, sg 6040 ft, dr 6080 ft.

COAL COUNTY—J. D. Petty Oil Co.'s McMillan 1, sw nw ne 16-1s-8e, dr 570 ft. Moore & Deaner's Edwards 1, nw ne se 27-2n-8e, dr 6625 ft.

COMANCHE COUNTY — F. F. Stevens' Green 1, se sw 2-1n-13w, lost bit and sd 1210 ft. Heiden-Taylor's Crutcher 2, cnw 11-1n-12w, td 863 ft.

GARVIN COUNTY—S. D. Denton et al's Gray 1, nw se 9-4n-3e, cellar and pits. Wm. H. Atkinson et al's Pharoah 1, nw nw nw 15-3n-2w, dr 2085 ft. Charles E. Carter et al's Wood 1, nw sw se 5-4n-3e, spd and sd.

GRANT COUNTY—Sultan Oil Corp.'s Patton 1, sw se 19-29n-3w, dr 4501 ft.

HARPER COUNTY—Sinclair Prairie's Neff 1, nw se 21-26n-24w, cored 5403-11 ft, running 9-in csg 5470 ft.

HUGHES COUNTY — Turner et al's Williams 1, sw sw sw 35-7n-10e, rig.

JACKSON COUNTY—Gypsy Oil Co.'s 1-A (twin) ne ne ne 1-1n-20w, sd 1170 ft. Ben Russell's Butler 1, nw ne 30-1n-22w, sd 3734 ft.

JEFFERSON COUNTY — George Pace et al's M. Jack 1, ne nw nw 10-4s-4w, cored 3010-23 ft, cored 3023-31 ft, sd 3032 ft.

JOHNSON COUNTY—Gled Oil Co.'s Layton Ream 1, sw se ne 26-2s-8e, dr 70 ft.

KAY COUNTY—Helmerich-Payne's Crouse 1, cne sw 29-25n-1w, fsg dr pipe 4256 ft.

KINGFISHER COUNTY—Jadeka Development Co.'s Frakes 1, csw ne sw 16-15n-6w, dr 7605 ft.

LEFLORE COUNTY—Murdock et al's Fee 1, sw ne sw 15-5n-25e, sd 2425 ft. Eastern Oklahoma O&G Co.'s Metcalf 1, sw sw sw 2-4n-26e, sd 2040 ft.

LINCOLN COUNTY — W. N. Anthony's Fruin Eckman 1, se se sw 4-16n-1e, sd 4960 ft. Mid-Continental Co.'s Bolby 1, cse sw 27-12n-2e, dr 4600 ft. Derrickson & Reserve Pet.'s Law 1, se sw ne 25-14n-3e, digging pits. M. Murray & Ralph Day's Rittenhouse 1, nw ne 26-14n-6e, set 15-in csg 60 ft, wocs. R. L. Kemp & Comail Oil Co.'s Dooley 1, ne sw 20-17n-6e, rig.

LOGAN COUNTY—Gypsy Oil & Sinclair Prairie's Manning 1, cnw nw 3-17n-4w, dr 6162 ft.

McCLAIN COUNTY — Benedum & Trees' James 1, se nw sw 19-5n-3e, dr 3535 ft.

MURRAY COUNTY—Ed Galt et al's Aetna Life Insurance 1, se nw nw nw 14-2s-3e, sd 1010 ft, D&A. T. E. Revels' Wolfe 1, ne ne ne 18-1n-2e, so 2658-70 ft, sd 2710 ft.

OKLAHOMA COUNTY — Sinclair Prairie Oil Co.'s Hoyt 1, nw sw ne 5-14n-3e, lcn.

OSAGE COUNTY—Empire Oil & Refining Co.'s 1, se ne 3-25n-3e, pumped 50 bbls. oil and 25 bbls water, comp. Norbla Oil et al's 1, se nw 19-25n-7e, hfw 1998-2045 ft, fsg one joint

Unusual durability
Metal-to-metal principle
Outstanding performance

Available in all standard bores in both tubing and rod types

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AXELSON
SUPER
SERVICE
PUMPS

6-in csg 2176 ft. Peters Petroleum & Norbla Oil Co.'s 1, sw sw sw 15-25n-5e, hfw 2135-2200 ft, set 8-in csg 2345 ft.

PITTSBURG COUNTY — P. H. Gray et al's Lee 1, nw se 12-5n-13e, dr 130 ft.

PONTOTOC COUNTY — Jarrett Petroleum's Johnson 1, se nw 28-4n-4e, cored 1620-28 ft, dry. Gillette & Kroeger's Duver 1, ne se 1-1n-6e, dr 678 ft, (cor. depth). J. D. Sledge & Jack Lynch's Thompson 1-A, (twin), sw ne sw 1-1n-7e, dr pipe stuck 3786 ft. Riddle et al's Barnes 1, se nw se 21-5n-4e, sd 2922 ft. Boyle et al's Newborn 1, sw ne 31-5n-4e, td 3210 ft, recementing. Southern Oil Corp.'s Ladd 1, cnw nw 27-3n-7e, dr 280 ft. Gillette & Kroeger's Robins 1, ne se 31-1n-6e, rog.

SEMINOLE COUNTY—Moran et al's Brindle 1, sw ne 27-6n-5e, so 2330-78 ft, dr 2485 ft. W. D. Grisso et al's Kenyon 1-A, cne se 24-8n-4e, set 6-in csg 4048 ft, rust. Harris-Haun's Harjo 1, ne se nw 11-6n-6e, (owpb), td 2175 ft. Mudge Oil Co.'s Whitney 1-A, se nw 9-6n-7e, dr 1698 ft. Verser & Clay et al's Thomas 1, ne se nw 1-6n-6e, sd 300 ft.

STEPHENS COUNTY—Carter Oil Co.'s T. H. McCasland 1, cnw nw sw 22-1s-4w, cored 4455-65 ft, so 4581 ft, cored 4581-4601 ft, 18½ ft recovery, so&g, conditioning hole for test. Finley et al's Woolsey 1, nw se 10-3s-6w, sd 440 ft, machine moved out. Heenan Coe et al's Hefner 1, se ne sw 13-3s-6w, rig and mit. Wm. Angle's Johnson 1, ne se 17-1n-8w, sg 1070 ft, dr 1140 ft.

WASHITA COUNTY—Oklahoma Mid-Western Oil Co.'s Dock 1, sw sw sw 21-8n-18w, rebuilt rig and sd.

MICHIGAN

ISABELLA COUNTY — Thompson Bros.' Isabella Bank 1, 14n-5w, Sec. 22, sd 1294 ft. Atha Oil Co.'s Little 1, 16n-4w, Sec. 31, dr 1290 ft. Arbaugh Bros.' Aldrich 1, 14n-6w, Sec. 22, dr 1130 ft. Youman and Wyckoff's Terry 1, 15n-6w, Sec. 30, r 1650 ft. Geo. Hanner's Dargitz 1, 13n-6w, Sec. 20, sp.

MIDLAND COUNTY — Goll-Graves-Mechling's Crane 1, 16n-2e, Sec. 21, sd 1300 ft. Atha Oil Co.'s Moran 1, 13n-1e, Sec. 23, Dundee 3454 ft, bottom hole 3481 ft, 2100 feet oil in hole, may acid treat.

OGEMAW COUNTY — McClanahan Oil Co.'s Boutell 1, 22n-1e, Sec. 5, dr 2400 ft; Canard 1, 21n-3e, Sec. 22, so 1900 ft. Muskegon Oil Corp.'s Wilson 1, 22n-1e, Sec. 24, dr 300 ft. W. C. Mee's Gibbs 1, 21n-3e, Sec. 30, dr 2630 ft. Melling Oil Co.'s State 1, 21n-3e, Sec. 6, dr 1974 ft.

MONTCALM COUNTY—Daily Oil Co.'s Christensen 4, 12n-6w, Sec. 4, dr 700 ft. Pure Oil Co.'s Tenney 1, 12n-6w, Sec. 3, pb from 3560 ft to 3000 ft, to treat in Traverse lime. Tope-Voorhees-Blunt's Neff Ranch 1, 11n-6w, Sec. 22, sd 2971 ft. Mammoth Petroleum Corp.'s Thomas 1, 12n-6w, Sec. 11, drilling out lead wool 3504 ft. L. E. Duvall's Eiknorch 1, 11n-10w, Sec. 13, dr 600 ft. Golden Oil Co.'s Steffensen 1, 10n-8w, Sec. 5, ru.

MECOSTA COUNTY—Alma-Mecosta Co.'s Sullivan 1, 14n-8w, Sec. 19, lcn. Gordon Oil Co.'s Brisboy 1, 13n-7w, Sec. 8, sp. Colmur Oil Co.'s State 1, 14n-9w, Sec. 24, dr 1245 ft. Consumers Royalty Co.'s Case 1, 15n-7w, Sec. 23, lcn. Sherman Oil Co.'s Flowers 1, 15n-7w, Sec. 33, lcn. Secord Oil Co.'s Van Houten 1, 13n-7w, Sec. 35, lcn. Columbia Oil & Gas Co.'s Arnett 1, 13n-8w, c-nw se 23, ru. Daily Crude Oil Co.'s Rouen 1, 16n-10w, sw se sw-24, sp.

GLADWIN COUNTY—M. F. Whitehall's Kintner 1, 17n-2w, Sec. 17, dr 3600 ft. Atlas Drilling Co.'s Cronk 1, 19n-1w, Sec. 23, sd 125 ft.

LIVINGSTON COUNTY—Talbot Oil Co.'s McPherson 1, 3n-4e, Sec. 35, dr 300 ft.

GRATIOT COUNTY — McClanahan Oil Co.'s Sullivan 1, 12n-3w, Sec. 33, ru. Ithaca Oil & Gas Co.'s Thum 1, 9n-1w, Sec. 19, dr 2800 ft.

SAGINAW COUNTY—Fred Turner's Sunrise Farm 1, 10n-4e, Sec. 6, dr 450 ft. Chapin Oil and Gas Co.'s Sutlif 1, Sec. 6, sd 2500 ft.

MISCELLANEOUS—Oakland County: T. F. Caldwell's Beecher-McKay 1, 1n-7e, Sec. 21, dr 2160 ft. Osceola County: Mellon & Pollock's Johnson 2, 17n-10w, Sec. 1, dr 1600 ft.

CALIFORNIA

KERN COUNTY

BLACKWELL'S CORNER—Amerada Pet. Corp.'s Beer 1, 17-26-19, recovered dr pipe, td 2723 ft, wocs 9-in 2540 ft.

COMANCHE POINT—Comanche Oil Co.'s No. 1, 15-32-29, sd 4325 ft. Tejon Ridge Oil Co.'s No. 1, 23-32-29, dr sandy shale 1200 ft.

McFARLAND—Home Corp.'s Jessup et al 1, 16-26-27, dr shale, streaks sand 1785 ft.

McKITTRICK—Standard Oil Co.'s No. 45, 15-30-22, coring, testing sandy shale 4745 ft. Welport Oil Co.'s No. 106, 26-29-21, oil sand; 10¾-in wocs 935 ft, td 990 ft.

MOUNT POSO—Ohio Oil Co.'s Brown 1, 22-27-27, wocs 8⅝-in 1339 ft, td 1368 ft.

PREMIER—Buckeye Union Oil Co.'s New Hope 1, 11-27-27, cellar. Formerly Vedder Pet. Corp.

NEAR MOUNTAIN VIEW—P. H. Greer Co.'s Percel 1, 9-31-29, lcn. Hogan Pet. Co.'s Earl Fruit Co. 1, 4-31-29, lcn.

NO. SEMITROPIC—S. T. Alexander Oil Co.'s Shields 1, 29-25-21, sd 1426 ft.

PIONEER ANTICLINE — Fisher & Welton's Harris 1, 35-11-23, sd 1156 ft.

TEMBLOR HILLS—Robt. Foster's No. 1, 2-32-22, dr shale 1910 ft.

SO. BUTTONWILLOW—101 Oil Co.'s No. 1, 5-30-24, rur.

WHEELER RIDGE—Badger Oil Co.'s El Tejon 1, 31-11-19, dr hard shale, streaks gray sand 6140 ft.

WEEDPATCH—Associated Oil Co.'s Di Giorgio 1, 3-31-29, rur.

KINGS COUNTY

TULARE COUNTY—Commonwealth Cons. Gas Co.'s No. 2, 21-22-20, rur.

PYRAMID HILLS—General Pet. Corp.'s Martin 1, 20-24-18, dr water well.

ALPAUGH—Trico Oil & Gas Co.'s Magee & Stone 1, 33-24-22, sd 3717 ft; Magee & Stone 2, 3-25-23, dr sandy shale 2170 ft.

DUDLEY RIDGE—Dudley Ridge Dev. Co.'s No. 1, 24-23-20, rig.

CANTUA CREEK—G & E Dev. Co.'s No. 1, 36-16-14, sd. Western Gulf Oil Co.'s S. P. L. 1, 11-17-15, coring shale 6480 ft.

DOS PALOS—Bergman Oil Co.'s Ora Loma Farms 1, 12-12-11, td 6006 ft, redr to 5390 ft sand. Russ Oil Synd's No. 1, 28-12-11, co 4370 ft.

MADERA COUNTY

DOS PALOS—Pure Oil Co.'s Chowchilla 1, 7-10-14, dr sand and shale 7930 ft.

SACRAMENTO COUNTY

CLAY STATION — Great American Pet. Co.'s Howard 1, 25-2n-8w, dr blue shale streaks gray sand 676 ft.

SAN JOAQUIN COUNTY

TRACY AREA—Milham Explor. Co.'s Moy 2, 24-3-4, dr shale 1200 ft.

SUTTER COUNTY

MARYSVILLE BUTTES—Buttes Oilfields' No. 2, 35-16-1e, dr shale streaks andesite 5700 ft.

TEHAMA COUNTY

CORNING—Northern Counties Pet. Co.'s Ewers-Maoney 1, 25-24-3, dr shale 1840 ft.

TULARE COUNTY

ALPAUGH—Mastodon Oil Co.'s No. 1, 27-24-23, rigged up.

YOLO COUNTY

GUINDA—Pacific Northern Oil & Gas Co.'s Guinda 1, 23-12-3, sd 6770 ft.

SANTA BARBARA COUNTY

GOLETA—Shell Oil Co.'s Bishop 1, 20-4-28, dr gray shale 4245 ft.

LOMPOC—Lompoc Pet. Co.'s Beauterbaugh 2, 18-7-34, sd 2975 ft.

LOS ALAMOS—Petroleum Securities Co.'s Hancock-Los Alamos 1, 31-8-32, sd 4808 ft.

SISQUOC—Royalties Service Corp.'s Sisquoc 1, 35-9-32, dr brown shale 3020 ft.

SANTA MARIA—Union Oil Co.'s Moretti 1, 24-10-34, pumping and bailing 100 bbls, 16.8 grav oil 2389 ft.

SUMMERLAND—Ortega Oil Co.'s Williams 1, 16-4-26, redr 3800 ft, plugged to 3785 ft, td 3831 ft.

SAN LUIS OBISPO COUNTY

CHOLAME—Willett Oil Assn's Jack 2, 10-25-15, dr shale 2020 ft.

TEMBLOR HILLS—Midway-Peak Oil Co.'s No. 1, 3-32-22, sd 1592 ft.

VENTURA COUNTY

BARDSDALE—Daniel Fisher's Elkins 1, 5-3-19, spudded Sept. 28.

LAS POSAS—Las Posas Pet. Co.'s Mahan 1, 22-3-20, sd 7370 ft.

OJAI—Continental Oil Co.'s Pirie 1, 12-4-23, foundation. A. N. Macrate's Cosmon 1, 27-4-23, sd 5541 ft. Rancho Oils' Rancho Santa Ana 1, 18-4-23, dr sand and shale 1832 ft.

PIRU—Piru Oil Co.'s Holser 1, 14-4-18, rur.

RINCON—Woodrow Pet. Corp.'s Woodrow 1, 4-3-24, td 7615 ft, redr 6030 ft.

SANTA PAULA—J. W. Mosher's No. 1, 22-4-21, r td 2290 ft.

SHIELL'S CANYON — The Texas Co.'s Shiells 128, dr os and shale 3902 ft.

SULPHUR MOUNTAIN—Wm. A. Kirk's No. 5, 21-4-22, pumping 30 bbls 17 gravity oil and 150 bbls water, td 2400 ft, plugging bottom.

SOUTHERN CALIFORNIA

ATHENS AREA—Woodward Oil Co.'s No. 1, 12-3-14, sd 5545 ft.

BREA CANYON — Pressel - Perry - Tull's Baird 1, 30-2-9, dr shale 3716 ft.

CARBON CANYON—Tehama Pet. Corp.'s Kramer 1, 33-2-8, dr shale 2710 ft.

CORONA—Corona Oil Co.'s Wardlow 1, 27-3-7, rig.

EAST RICHFIELD—Midrich Drilling Co.'s Vejar 1, 26-3-9, dr hard shale 3935 ft.

HUNTINGTON BEACH, on tidelands—Black Eagle Oil Co.'s No. 1-B, permit 194, 32-5-11, sd 4049 ft.

MANHATTAN BEACH—Staple Oil Co.'s No. 1, 24-3-15, dr shale 3905 ft.

NEWPORT—Piatt & Collins' No. 1, 14-6-10, sd 2574 ft. Pioneer Drilling Co.'s Banning 3, 29-6-10, sd 6452 ft.

NO. LONG BEACH—Geo. L. Clayton's No. 1, 31-3-12, washing over dr pipe, td 6750 ft.

PUENTE—N. O. Shively's Rowland 1, 23-2 10, rig. Signal Pet. Co.'s Rowland 2, 23-2-10, to test, td 2545 ft.

SAUGUS — International Oil Developer's Powell 1, 34-5-16, dr hard sand and shale 3361 ft.

SURF—W. G. Bradford's B. B. 1, 19-6-10, rur.

EAST TORRANCE—Thos. Kelly & Sons' Del Amo 1, 7-4-13, sd 6433 ft.

VENICE—Big Ben Oil Co.'s No. 1, 27-2-15, cellar. Chas. Fourl's Fourl 1, 27-2-15, dr black shale 6040 ft

RIVERSIDE COUNTY—Great Coastal Oil Corp.'s No. 1, 35-5-5, lcn.

SAN BERNARDINO COUNTY — Great American Pet. Co.'s Gapco B-1, 18-2-8, co td 3167 ft; Gapco D-1, rur.

MONTANA

BIG HORN COUNTY—Enterprise Oil Co. and Embar Drilling Co.'s Lynde 2, sw sw se 21-6s-35e, dr out cement with 4¾-in csg set at 3590 ft.

FERGUS COUNTY—H. C. Rowland et al's Woodward 1, se se sw 20-14n-24e, dr at 2923 ft.

LIBERTY COUNTY—J. H. Hamilton Syndicate's Northern Farms 1, ne sw 10-37n-5e, fsg for lost underreamer lug with hole bottomed at 1565 ft.

PETROLEUM COUNTY—Guy Smith et al's Test 3, ne se sw 33-14n-26e, spd at 140 ft. Guy Smith et al's Operator 2, se se 3-13n-26e.

WYOMING

ALBANY COUNTY—California Co.'s Holst 1, ne se se 13-17n-77w, dr at 1500 ft.

BIG HORN COUNTY—J. W. Bales et al's Parker 1, csw sw 23-49n-89w, dr at 165 ft.

CARBON COUNTY—Argo Oil Co.'s Government 1, se 5-24n-87w, building derrick. Earl W. Reader, Inc.'s Union Pacific 1, c sw sw 19-20n-83w, dr at 5500 and fsg for lost tools. Earl W. Reader Inc.'s Whitford 1, sw sw se 24-20n-84w, cellar and pits completed. Ohio Oil Co.'s Sid Morris 1, cnw se 6-20n-77w, sd at 2874 ft.

CONVERSE COUNTY—R. J. Dilger et al's Government 1, se ne sw 33-31n-72w, dr at 675 ft with 8⅝-in csg set at 626 ft.

FREMONT COUNTY—Sidney H. Keoughan and Monongahela Oil Co.'s Wisda 1, ne se se 13-28n-93w, sd at 2780 ft. Mid-American Oil

Co.'s Government 1, ne sw 4-28n-92w, dr at 2530 ft.

HOT SPRINGS COUNTY—California Exploration Co.'s Government 1, ne se ne 12-44n-97w, dr at 2755 ft.

SHERIDAN COUNTY — Sheridan Syndicate's Allison 1, sw se 15-55n-85w, dr cut cement with 8¼-in string set at 2050 ft.

WESTON COUNTY — Conway Oil Co.'s Government 1, se se nw 7-41n-60w, dr at 585 ft.

COLORADO

ADAMS COUNTY—Riddle Petroleum Co.'s Baxter 1-C, sw 2-3s-66w, Derby Dome, waiting for rotary equipment and planning to dr water wells.

ARCHULETA COUNTY — Oil City Petroleum Co.'s Garnett 2-X, Lot 3, ne sw 25-33n-52e, dr at 514 ft. Navajo Oil Co.'s Crowley 1, sw ne 11-32-1e, Chromo district, abd at 390 ft.

BOULDER COUNTY—L. R. Steele's Coles 1, nw nw ne 33-1n-70w, dr at 2330 ft.

EL PASO COUNTY—Colorado Springs Oil & Natural Gas Co.'s Carson 2, nw ne ne 10-16s-66w, abd at 2504 ft.

GRAND COUNTY — Colorado Oil Refining Co.'s Linke 1, ne sw sw 13-1n-77w, sd at 1710 ft.

JACKSON COUNTY—Colorado Oil Refining Co.'s North Park Coal Co. 1, nw nw 18-9n-78w, sd for winter. Continental Oil Co.'s Hoye 3, nw ne 34-9n-78w, dr at 2217 ft.

LINCOLN COUNTY — Consolidated Smelting and Metals Corporation's Hancock 1, ne nw se 7-17s-52w, rig completed for rotary equipment.

PARK COUNTY — South Park Oil Co.'s State 1, se se sw 16-11s-17w, dr at 250 ft with 500,000 cu ft gas.

PROWERS COUNTY — Trojan Oil & Gas Co.'s Lotus 1, nw ne ne 15-23s-46w, dr at 3833 ft.

NEW MEXICO

CHAVES COUNTY—Roswell Oil Syndicate's Hinkle 1, ne se 17-11s-27e, spd and sd at 75 ft. Roswell Insurance Surety Co.'s Franks 1, ne se 30-11s-25e, dr at 965 ft.

McKINLEY COUNTY — Royer Oil Co.'s Test 1, sec 14-15n-10w, Ambrosia Lake area, mim.

ROOSEVELT COUNTY—Claudell Development Co.'s Wilmes 1, sw se 21-2s-30e, dr in hard sand at 705 ft.

SAN JUAN COUNTY—Spence, Healy & Stowe's Test 1, sec 14-29n-11w, dr below 650 ft with show of oil and gas. Webb Holding Co.'s State 1, nw 6-30n-11w, spd.

SAN MIGUEL COUNTY — Cabra Springs Oil & Gas Co.'s Pino Mesa 1, ne se 22-12n-22e, milling on rope socket at 3770 ft with td of 3803 ft. Cabra Springs Oil & Gas Co.'s Pino Mesa 2, csw 19-12n-22e, spd at 275 ft. Deason et al's Test 1, se sw 14-15n-16e, spd at 253 ft.

SANTA FE COUNTY—Fisher & Wolcott's Hill 1, sw 6-10n-6e, dr below 2140 ft with so at 2095 ft. Kelsey Client's State 2, cnw 22-10n-10e, preparing to resume at 1105 ft. Holmberg Interests' Cantwell 1, nw ne 5-10n-9e, dr at 650 ft.

TORRENCE COUNTY—Fisher & Schmale's Test 1, sec 15-9n-8e, lcn.

VALENCIA COUNTY—Ringle Development Corporation's Tome Grant 1, ne 20-6n-3e, rigged and ready to spd. Same company's Tome Grant 2, sw 35-6n-3e, lcn.

ALABAMA

HOUSTON COUNTY—Rice O&G Co.'s Oakley Est. 1, nw sw 9-3n-29e, sr td 2550 ft.

LAMAR COUNTY—DeSoto O&G Co.'s Gardner 1, nw nw 22-15s-16w, sd 4182 ft.

PIKE COUNTY—Alabama Drilling Co.'s Faulk 1, nw nw 31-11n-21e, mim.

FLORIDA

DADE COUNTY—Miami, Fla., Oil Co.'s Chevalier Corp. 1, 19-54s-35e, fsg 4565 ft. East Coast Oil & Nat. Gas Co.'s Warwick 1, 12-55s-40e, owdd, td 5432 ft.

HILLSBORO COUNTY — Southern Pet. Co.'s Mizell & Williams 1, c n½ 4-32s-21e, dr 200 ft.

WALTON COUNTY—Oil City Corp.'s Walton L&T Co. 1, 12-1n-19w, dr 5225 ft.

ARKANSAS

HEMPSTEAD COUNTY—Arkansas Drilling Co.'s Jones 1, ne se 11-14-24, sd 2795 ft. F. W. Martin & Co.'s Lafferty 1, se nw 17-14-24, dr 2755 ft.

LA FAYETTE COUNTY—W. H. Harvey's A. M. Allen 1, ne sw 18-19-24, 2500 ft oih, wosr, td 2781 ft. A. M. Allen 2, se sw 18-19-24, dk. Wadley-Erwin Tr. et al's Bodcaw Lbr. Co. 2, se se ne 19-16-23, dr 2130 ft.

MILLER COUNTY—Beverly Oil Co.'s Commercial Bank 1, sw ne se 30-17-28, dk. Bloomburg Oil Corp.'s Patterson 2, 5-19-28, lcn. King Oil Corp.'s Schroder 1, sw ne 24-14-28, arr test, td 2587 ft. Oilwell Oil Corp.'s Burt Dodd 1, sw ne 10-19-28, dr 3610 ft. Rhone, Ford & Goodwin's Frost Est. 1, se sw 8-15-26, dk. Lee Timberlake's Frost Est. 1, sw se 27-15-26, spd.

OUACHITA COUNTY—J. S. Carnes' D. Scott 1, nw sw ne 18-14-18, cored sw sand 2052 ft, pb to 1835 ft.

UNION COUNTY—Mrs. R. K. Jones' J. Davis 1, nw nw 28-16-14, setting 6⅝-in csg, td 2765 ft. Reuter Oil Co. Inc.'s Kinard 1, se nw 32-18-14, dry so 2157 ft, dr 2185 ft. Short & Hayes' J. W. Taylor 1, nw nw se 10-17-14, rur.

WOODRUFF COUNTY—L. P. Lively's P. Perkins 1 sw se se 5-5n-2w, rur.

MISSISSIPPI

BOLIVAR COUNTY—White & Jones' Ballou 1, se se nw 17-24n-7w, rur.

GREENE COUNTY—United Gas Pub. Serv. Co.'s School Board 1, w½ w½ 16-1n-5w, spd.

JONES COUNTY—Snow-Black Pet. Co.'s Watson 2, ne sw 24-7n-13w, fsg 4004 ft.

LAUDERDALE COUNTY — Dalton Dev. Co.'s Bounds 1, 34-7n-15e, wocs 560 ft.

MONROE COUNTY—P. J. McAlpine et al's Frank Rye 1, ne sw 15-15s-17w, top Paleozoics 595 ft, dr 1100 ft. Chas. Rye 1, se sw 22-15s-17w, sd 2917 ft. Crook 1, ne ne 4-13s-18w, ruct, owdd, co at 600 ft, td 720 ft.

PEARL RIVER COUNTY—Gulf Ref. Co.'s Goodyear Yellow Pine 1, nw nw 21-3s-17w, owdd, rur to deepen, td 2900 ft.

SIMPSON COUNTY—Berry Corp.'s R. T. Berry 2, sw sw 33-2n-4e, arr dr plug in 6⅝-in csg 2048 ft. J. N. Little 1, ne ne 32-10n-21e, dk.

STONE COUNTY—Gulf Ref. Co.'s Dantzler Lbr. Co. 6, sw sw 22-4s-11w, spd dr 100 ft.

WALTHALL COUNTY—Mutual O&G Co.'s Boyd 1, sw sw 19-2n-10e, rog.

WARREN COUNTY—Harry W. Elliott's R. L. Parker 1, 14-14n-1e, pb to 2100 ft.

NORTH LOUISIANA

BIENVILLE PARISH—Benedum & Trees Oil Co.'s Sprawls 1, ne nw 7-15n-6w, dr 3300 ft. Duncan & Fuller's J. Hutton 1 (formerly carried Drake Estate 1), nw nw 4-18n-7w, dk. T. L. James & Co.'s Harrison 1, nw nw 2-16n-6w, spd 12-in csg 306 ft. Saline Drilling Co.'s Pardee 1, ne ne 27-14n-6w, arr res 160 ft.

BOSSIER PARISH—Jno. L. Anderson, Tr.'s Leonard 1, sw sw 19-19n-13w, sd 3743 ft. L. M. Moffitt et al's W. H. Martin et al 1, sw nw 2-21n-12w, rur. Producers O&G Co.'s W. H. Werner 1, se se 7-17n-11w, sd 3990 ft. W. A. Kirklin, Tr.'s Garrett & McKellar 1, se nw nw 3-21n-13w, rur.

CADDO PARISH—O. L. Hickman's Fee 1, 36-17n-13w, rur.

CALDWELL PARISH — Terrell & Price's La. Central Lbr. Co. 1, nw ne 18-11n-3e, sd 3485 ft.

CLAIBORNE PARISH—Bundy et al's J. K. King 1, 12-21n-7w, dk.

CATAHOULA PARISH—T. R. Hincey's La. Central Lbr. Co. & Tensas Delta Lbr. Co. 1, sw ne 32-9n-6e, 10-in csg 164 ft.

DE SOTO PARISH—L. H. Alderson's P. B. Peak 1, nw ne 25-11n-13w, sd 3070 ft. Century Oil & Drilling Co.'s J. M. Norton 1, sw ne 27-11n-using acid, 1620 ft. Dempsey & Manziel's Thigpen 1, sw ne 33-13n-13w, dr 1700 ft. E. L. Foster et al's Youngblood 1, ne ne 9-11n-14w, owdd, td 1502 ft. Geo. Le Grande's Vaughan 1, nw sw 1-11n-16w, spd dr 385 ft. E. T. Oakes' Johnson 1, ne nw 30-13n-15w, si after sg, setting liner to test, td 5416 ft.

EAST CARROLL PARISH—Holcomb & Thomasson's Millikin 1, ne ne 22-23n-12e, rur.

NATCHITOCHES PARISH — Benedum & Trees Oil Co.'s Carver 1, se se 6-8n-7w, spd dr 50 ft. Clyde Creighton's Friedman 1, sw sw 52-7n-6w, arr res 1090 ft. Jack Lent's Brown Lbr. Co. 1, ne sw 27-9n-9w, cemtd 6⅝-in csg 2480 ft. Missouri Drilling Co.'s Brown Lbr. Co. 1, se se 5-10n-10w, arr res 890 ft. Roy Raines et al's Fee 1, sw sw 28-9n-10w, sd for water, 2605 ft.

RED RIVER PARISH—Cope et al's R. M. Thomas 1, nw se 34-13n-8w, cemtd 7-in csg 1600 ft, td 1700 ft. O. K. Oil Co.'s Franklin Realty Co. 1, sw se 32-9n-11w, mim.

SABINE PARISH—R. L. Gay, Tr.'s Long-Bell Lbr. Co. 4, ne ne 5-8n-13w, rur. Tex-La-Ark Oil Co.'s Pickering Lbr. Co. 1, ne sw 3-3n-12w, sd 2192 ft, top Wilcox.

TENSAS PARISH—H. B. Schumacher, Tr.'s Curry 1, nw nw 39-11n-12e, owdd, td 3750 ft.

WEBSTER PARISH—W. N. Neely's R. B. Slack 1, nw nw 12-22n-11w, dk.

WINN PARISH—Red River Ref. Co.'s Tremont Lbr. Co. 3, 26-11n-1w, lcn.

LOUISIANA GULF COAST

ACADIA PARISH — Woodley Pet. Co.'s Daigle 1, sec 24-7s-1e, abn 8415 ft; top Discorbis 6860 ft, Heterostegina 7133 ft, Marginulina 7506 ft.

ALLEN PARISH—Humble's Industrial Lbr. Co. 1, sec 21-3s-5w, dr shale 6989 ft.

BEAUREGARD PARISH—Gulf's Lutcher Moore 1, sec 25-6s-12w, dr sand 3980 ft.

CALCASIEU PARISH—Union Sulphur Co.'s Barbee Estate 2, sec 11-9s-8w, 6760 ft woc.

CAMERON PARISH—Texas Co.'s Calcasieu Lake 10A, sec 1-14s-9s, drill stem stuck 4962 ft.

EAST FELICIANA PARISH — Thompson Creek Oil Co.'s Fanny Noland 1, sec 70-1s-1w, dr shale 700 ft.

EVANGELINE PARISH—L. Puckett's Vidrine 1, sec 34-3s-2e, sd.

LA FOURCHE PARISH—Barnsdall Oil Co.'s Herang Plantation 3, sec 97-17s-20e, drill stem stuck 6252 ft. R. L. Gay's Gedchaux 1, near Raceland, sd 6226 ft.

PLAQUEMINES PARISH—E. A. Howe's Buras Levee 1, sec 26-21s-30e, woc 1533 ft.

RAPIDES PARISH—J. B. Evers' Wattermark 1, sec 35-6n-2e, sd. C. D. Loe's Barrett 1, sec 40-5n-1w, ru sd.

ST. BERNARD PARISH—J. Danciger's Battles 1, sec 135-14s-14e, dr shale 4130 ft.

ST. MARTIN PARISH—The Texas Co.'s St. Martin Ld. Co. 6, sec 17-8s-7e, dr lime 8817 ft.

TEXAS GULF COAST

BRAZORIA COUNTY — Amerada Pet. Corp.'s Houston Farms Dev. Co. 1, L. G. Bachelder Survey, 6736 ft, woc. Glen L. Bruner's Truska 1, HT&B No. 7 sur (75-ac), Discorbis 5806 ft, dr shale 6818 ft. Harrison & Abercrombie's Bernard River Land Co. 1, C. Breen sur (103-ac), elev 3514 ft, Discorbis 6545 ft, Heterostegina 7230 ft, dr 7346 ft. Pat Rutherford & W. H. McCarthy's Nat'l Life Ins. Co. 1 (469-ac), H. Austin Lge. 4, A-12 sur, dr sand 4740 ft. Stanolind O&G Co.'s J. W. Surface 1 (75-ac), ACH&B abst 462 sur, mim.

CHAMBERS COUNTY — Sun Oil Co.'s Hamilton 1 (640-ac), T&NO sec 128 sur, dk.

GALVESTON COUNTY — Gillock Pet. Co.'s Spoor 2, W. K. Wilson sur, spudded. Humble O&R Co.'s Maco Stewart 1-B, J. Sellers sur, shale 7725 ft, woc. Pure Oil Co.'s Schelor 1 (231-ac), BBB&C sur, Discorbis 6554-6989 ft, woc.

HARDIN COUNTY—Kirby Pet. Co.'s H& TC 1, 1450 ft fr e line, 332 ft fr n line of H. & T. C. survey section 226, lcn.

HARRIS COUNTY—American Liberty Oil Co.'s J. J. Sweeney 1, W. C. R. R. sur, blk 4, sec 12, top Heterostegina 3295 ft, dr shale 5145 ft. C. B. Bunte's Lackner 1, H. Renerman sur, reaming 2545 ft. W. U. Paul's House 1, M. Magruder sur, elev 103 ft, top Oakville 2380 ft, Catahoula 2524 ft, Heterostegina 3559-79 ft; in Frio 3846 ft, td 3864 ft, sdtr 1600 ft.

JEFFERSON COUNTY — Magnolia Pet. Co.'s Hebert Trust 1, P. H. Bell sur, dr lime 7990 ft. Sun Oil Co.'s Long 1 (1202-ac), J.

Blair sur, top Warreni 7818 ft, dr cement 6311 ft.

LIBERTY COUNTY—Extension Oil Co.'s Lovett 1, P. P. Dever sur, sd 3403 ft. Liberty Independent Oil Co.'s J. M. Neal 1 (100-ac), S. Strong sur, dr shale 2541 ft. Jack Frazier's Lynotte Buffon 1 (865-ac), James Robeson sur, elev 50 ft, top Discorbis 3610 ft, Heterostegina 3790 ft, Frio 3946 ft, repairing boilers 4748 ft.

MATAGORDA COUNTY—Continental Oil Co.'s Robbins 1 (1500-ac), J. C. Franz sur, elev 19 ft, top Discorbis 5815 ft, Marginulina 6980 ft, fsg 6995 ft.

POLK COUNTY—Alpha Pet. Co.'s Martha Roberts 1 (100-ac), J. F. DeRumayor sur, top Hockleyensis 4222 ft, elev 141 ft. Dick Schwab's Lynch 1, 330 ft fr n line and w line of 200 acre tract in Janeson survey, lcn. Johnson Brother's J. S. Smith 1 (55.1-ac), I. Parker sur, topped Operculina 3782 ft, Cockfield 3805 ft, dr shale 3851 ft.

WALKER COUNTY—E. P. Kilgore's Lampkin 1 (1014-ac), Holcombe sur, dk. Barnett et al's Reynolds 1 (93.75-ac), L. R. Clapp sur, dr shale 1750 ft. L. S. Flannery, Inc.'s, Tex. L. L. L. Co. 1 (5-ac), M. Milsap sur, elev 290 ft, top Crockett 1375 ft; Sparta 1782 ft; abn 2136 ft. East Texas Prod. Co's Tex. L. L. L. Co. 1 (30-ac), G. G. Chisum tract in F. Willis sur, elev 260 ft, top Crockett 1368 ft; Sparta 1779 ft; dst 2000-20 ft., 5 stands fresh water, abn 2524 ft. Lion Oil Co.'s Stokes Heirs 1 (52-ac), J. Callahan sur, elev 231 ft, coring 1950 ft.

WHARTON COUNTY—Texas Gulf Producing Co.'s E. Kresta 1, E. T. R. R. sec 54 sur, elev 107 ft, top Discorbis 4356 ft, Marginulina 4822 ft, Frio 5085 ft, salt water sand 6323-33 ft, dr water sand 6471 ft.

EAST TEXAS

ANDERSON COUNTY—Byrd-Frost, Inc. & Stanolind O&G Co.'s J. T. Burrow 1 (80-ac), M. Vascue sur, Slocum area, elev 408 ft, Pecan chalk 4248-4492 ft; Austin chalk 5096-5307 ft; top Woodbine sand 5365 ft, dry and abn in sw sand 5631 ft. Trinity State Oil Co.'s Trinity River 1, Cayuga field, rig. Al Helberg et al's D. L. Gibson 1, W. T. Sadler sur, lcn. J. W. Luttes et al's C. M. McKee 1 (100-ac), Walter F. Pool sur, 3 mi se of Frankston, dk.

BOWIE COUNTY—Tex-Ark Oil Co.'s J. B. Hamilton 1 (319-ac), Jessie Milam sur, rog.

CASS COUNTY—Eastern Texas Pet. Co.'s J. S. Baker 1 (97-ac), Jessie Walling sur, elev 395 ft, Pecan chalk 2308-2925 ft, dr 3590 ft. Remley-Nelley & R. Kamon Group No. 1's I. O. Savage 1 (121-ac), Mary Patterson sur, elev 351 ft, Pecan chalk 2030-2488 ft, sd 4016 ft. E. S. White and A. D. King et al's G. W. Allday 1 (40-ac), R. F. Whittaker sur, 4 mi ne of Linden, lcn. H. F. Wilcox et al's S. A. Orr 1 (316-ac), G. W. Morris sur, elev 381 ft, sd 3887 ft.

CHEROKEE COUNTY—H. L. Hunt Prod. Co.'s T. R. Black 1 (50-ac), D. W. McNabb sur, Rusk pool, lcn. Jacksonville O&G Corp.'s H. D. Henderson 1 (40-ac), J. Pineda sur, elev 409 ft, dr 480 ft. Guy C. Jameson et al's T. F. Millinix 1 (20-ac), T. M. Garrett sur, rig. Killough et al's J. S. Strickland 1 (40-ac), Urian Moore sur, 7 mi nw Jacksonville, sp and sd. Leetex Oil Co. (Wm. A. Stone's) J. J. Tullis 1 (157½-ac), W. M. Johnson sur No. 162, dk. Wm. McCulloch-Ed. Zilkey & K. Hughes' J. C. Bradford 1 (50-ac), J. Armendaris sur, top Pecan chalk 4070-4445 ft; Austin chalk 4914-5134 ft; dry and abn in sw sand 5177 ft. Rowan-Nichols Oil Co.-Simms Oil Co.'s C. V. Gilbreath 1 (60-ac), H. M. Brewer sur, Reklaw area, lcn. E. M. Thomasson & Co.'s J. J. Tullis 1 (153-ac), Jessie T. Jones sur, elev 471 ft, sp and sd. Wilson-Stubbs Oil Corp.-J. C. Patty Oil Co.'s Lucy Roberts 1, J. D. Wolfin sur, sd 1550 ft.

ELLIS COUNTY — Beckner & Findley's Coker 1, R. de la Pena 11 League Grant, sp and sd.

FREESTONE COUNTY—Walter M. Burress et al's J. B. H. Orand 1 (50-ac), W. M. C. Jones sur, 1¾ mi n of Fairfield, sd 1000 ft. J. P. Haley & Young's G. Cochrum 1 (380-ac), D. Bullock sur, 1 mi se of Luna, lcn. J. E. Milburn & J. B. Pattly's S. E. McAshan 1 (40-ac), S. G. Diaz sur, blk 178, sp and sd. E. L. Smith Oil Co.-W. A. Reiter et al's E. J. Barker 1, A. G. Smith sur A-731, 13 mi s of Fairfield, sp. Pete N. Wiggins, Jr., & Lee I. Dodwell's Pasadena Co. 1 (500-ac), J. Graham sur, 2½ mi e of Teague, rig.

HENDERSON COUNTY — Cosden Oil Corp.'s Hurt-Miller 1 (80-ac), J. B. Hays sur, 5 mi n of Frankston, dr 1150 ft. J. C. Crosby & Culp's M. T. Dodd 1 (160-ac), Geo. Aldrich sur, 4 mi e of Malakoff, elev 376 ft, Pecan chalk 2390-2504 ft; sd 3120 ft. Great State Oil Corp. (Dick Andrade & R. S. Bond's) R. Sid Ansley 1, N. B. Thompson sur, elev 289 ft, top Austin chalk 2608 ft, sd 2680 ft. Wm. C. McGlothlin et al's Paul Lewis 1 (88.3-ac), Daniel Lacy sur, nw of Trinidad, lcn.

HOPKINS COUNTY—D. A. Hale et al's L. M. Hall 1 (70-ac), A. Caro sur A-143, elev 506 ft, sd 640 ft. Hill & Hill, Inc., et al's J. W. Jones 1 (220-ac), Jasper Williams sur, lcn.

HOUSTON COUNTY — American-Liberty Oil Co.'s J. J. Sweeney 1 (320-ac), Sec. 17, blk 4, Washington Co. RR. sur, elev 113 ft, lcn. Adams et al's A. Lovelady 1 (55-ac), J. J. Thomas sur, 1¼ mi e of Lovelady, rog. Lacey & Miller's J. A. Hanner 1 (460¼-ac), W. M. Dillard sur, 2 mi ne of Weldon, elev 221 ft, cem sur cas 221 ft. Trinity Development Corp.'s G. A. Knox 1 (150-ac), Wm. Prissick sur, 6 mi w of Lovelady, dk.

HUNT COUNTY—G. S. & S. Oil Co.'s Oscar Popper 1 (101-ac), Jas. H. Moore sur 544, elev 534 ft, top red beds 2368 ft, top lower Woodbine 2640 ft, tested sw at 2462-2652 ft and abn. Julian C. Hall et al's A. B. Parrish 1 (100-ac), (S)Nancy Danley sur, rog. L. G. Priest et al's A. Barnett 1 (212-ac), J. C. Hamer sur A-417, elev 607 ft, dr 1950 ft.

LEON COUNTY—Killough & Tucker's G. B. Young 1-A (100-ac), Jas. B. Boone sur, elev 227 ft, Pecan chalk 3950-4070 ft; Austin chalk 5140-5390 ft, dry and abn in Eagleford shale 5548 ft. Normangee Corp.'s B. F. Henry 1, (125-ac), R. Rogers sur, sp and sd.

LIMESTONE COUNTY — David J. Crawford et al's Vol DeLong 1, Pedro Varela sur, 2½ mi n of Thelma, sd 1650 ft. Dan H. Daugherty et al's Sallie Welch 1 (94-ac), Pedro Varela sur, lcn. J. P. Davidson et al's J. M. Childs 1 (60-ac), J. Nelson sur, blk 3, lcn. Peyton Bros. et al's Jake Steubenrauch 1 (246-ac), Pedro Varela sur, w flank of Mexia field, elev 541 ft, top Glen Rose 4580 ft, dr 5720 ft. J. E. Schultz et al's Roy Ward 1 (23-ac), Harrison York sur, dk. V. V. Waite et al's Cannon Barron 1 (320-ac), W. G. McKenzie sur, 4 mi n of Thornton lcn. Watson & Stewart's Fox 1 (127-ac), H&TC Ry. sur, Prairie Hill area, lcn.

MORRIS COUNTY—H. N. H. Drlg. Co.'s E. Hall 1 (177-ac), Levi Jordan sur, top Pecan chalk 2360 ft, sd 4000 ft. C. L. Simpson et al's P. M. Staggers 1, J. D. Nelson sur, Pecan chalk 2520-2955 ft, r 3927 ft.

NAVARRO COUNTY—Bennett Bros. et al's T. E. Stewart 1 (83-ac), W. R. Bowen sur, sd 1186 ft. R. B. Godding et al's W. Kent 1 (48½-ac), C. B. Emmons sur, sd 1340 ft. W. J. Keeling Estate et al's J. F. Rushing 1 (84-ac), Henry Ford sur, 6 mi w of Currie, elev 530 ft, Austin chalk 2155-2395 ft, top Woodbine sand 2858 ft, sd 2873 ft. L. N. McCulloch et al's C. D. & J. L. Berry 1 (35-ac), W. W. Moss sur, sd 620 ft. R. L. Wheelock-J. L. Collins, Magnolia & Humble's I. N. Cerf 1 (147-ac), Jas. Smith sur, w flank of Corsicana-Powell field, elev 435 ft, top Woodbine 3827 ft; top Georgetown 4807 ft; top Glen Rose 4730 ft; dr 6475 ft. Syam Oil Co.'s Mrs. W. D. Ray 1, Elisha Powers sur, dk.

RAINS COUNTY—J. K. Wadley & J. W. Halsell's T. F. Jones 1 (22-ac), BBB&C Ry. sur, elev 425 ft, Pecan chalk 2503-2700 ft; top Austin chalk 3970 ft; sd 4730 ft. Rio Oil Corp.'s O. L. J. Easter 1 (39-ac), R. Hotchkiss sur, elev 432 ft, Pecan chalk 2183-2483 ft; jkd 3924 ft, skid rig.

RUSK COUNTY—Ben E. Lamb et al's Haywood Leath 1 (185-ac), L. J. Dooley sur, 2½ mi e of Pirtle, sp and sd.

SMITH COUNTY—R. W. Fair et al's W. P. Rushing 1 (50.8-ac), Jacob Herrin sur, elev 393 ft, top Pecan chalk 3130 ft. Austin chalk 4000-4250 ft; sd 4400 ft. A. G. Deck et al's Dora Kendall 1, John Williams sur, 3 mi e of Van field, sp and sd. Paul S. Williams et al's Dean 1 (100-ac), Denson Moore sur, dk.

UPSHUR COUNTY—Joe A. Papadakis et al's J. E. Reynolds 1 (103½-ac), J. B. Davenport sur, 5 mi nw of Gladewater, lcn.

VAN ZANDT COUNTY—J. C. Acre et al's F. W. Anderson 1 (160-ac), John Blair sur, 4 mi n of Wills Point, sp and sd. W. E. Brown et al's First Nat'l Bank (Edgewood) 1 (100-ac), M. V. Lout sur, elev 515 ft, top Pecan chalk 2892 ft; top Austin chalk 3999 ft, dr chalk 4115 ft. Pete Corley et al's J. L. Slaton 1, Wm. Carlton sur, 3 mi se of Ben Wheeler, dk. Green & Wynn's A. L. Eaton 1, L. Smith sur, lcn. Florence Oil Co.'s Sanger Inv. Co. 1 (50-ac), J. Walling sur, dr 1650 ft. Hodges & Schwartz et al's S. E. McKenzie 1 (106-ac), Wm. Daniel sur, testing sand 1204-1210 ft. Martin & Evans' J. R. Bryant 1, dk. S. E. Miller et al's J. M. Palmer 1 (39.1-ac), blk 14, NCSL sur, sd 620 ft. Rauch Bros. et al's Bearden-Palmer 1 (61.1-ac), blk 11, NCSL sur, sd repairs 1240 ft.

WOOD COUNTY — Alex M. Snyder & Shaw's J. T. Holmes 1 (122-ac), A. N. McKnight sur, A-399, Pecan chalk 3400-3700 ft; top Austin chalk 4776 ft, top Woodbine 4910 ft, dr 4970 ft.

HARRISON COUNTY—Hanover & Carroll's Buchanan 1, Crawford sur (near Hallesville), spd dr 1700 ft. R. C. Payne's Lowery 1, E. D. Spain sur, fsg 3524 ft.

MARION COUNTY—Fagan & Salman's Colgin 1, M. G. Nall sur, arr deepen, td 2385 ft. Smyley & Dodd's Henderson 1, R. Bennington sur, blg td 2385 ft.

PANOLA COUNTY—R. H. Davis' Wooten 1, Winney Mann sur, sd 2075 ft. Givens & Holloway's Wooten 1, Winny Mann sur, dr 2020 ft. R. W. Price's A. A. Crawford 1, Jas. A. Williams sur, rog. Stovall Drilling Co.'s Ivy 1, P. Martin sur, sd 1785 ft.

SOUTH TEXAS

BANDERA COUNTY—A. P. Crane & Co.'s Watson 1, A. Curvier sur, Sec. 71, td 1790 ft. Peerless Oil & Gas Co.'s R. G. Garrison 1, Sec. 506, straightening hole, td 496 ft.

BASTROP COUNTY—Cole Pet. Co.'s American National Bank 6, R. Gage sur, dr 600 ft. Joe Mills et al's Wm. Litton 1, Navarro sur, td 1753 ft, dr out plugs; Mrs. W. H. Cardwell 1, A. Navarro sur, prep to sp.

BEE COUNTY—Luling Oil & Gas Co.'s Ruhman 4, blk 13, prep to sp. Wm. F. Morgan et al's Hicks-Hahl 1, Sec. 43, Normanna area, lcn. Firm Oil Co.'s (Falvey) Gardner 1, F. Lewis sur, set csg 3064 ft, wocs. Hewitt & Hahn's Geo. Ray 1, prep to sp. Bill Hindeman's Imogene Hall 1, H. W. Fontaine, ru. Humble Oil & Ref. Co.'s Daniel Fox 1, M. Fox sur, sp. Edwin M. Jones' D. E. Robinson 3, Ragley sub, Uranga Grant, td 4405 ft, pb 3940 ft, prep to complete at 3910-37 ft. Tuleta Oil Co.'s G. A. Ray 1, W. B. Blanchard sur, move in machy. R. J. Worthington et al's Rutledge 1, B. Q. Hadley sub, dr 2000 ft.

BEXAR COUNTY—M. J. Crouch et al's Hoch 3, S. McCullough sur, testing 755 ft. McPhee & Briggs Florence Lamb 1, M. de Luna sur No. 4, coring 1038 ft. Linda Oil Co.'s Tomasi 1, R. Perez sur, td 1452 ft, test sulphur water in Edwards lime, pb 943-85 ft, testing. Ricker & Auld's C. H. Kearney 1, Villapando sur No. 142, dr 1250 ft. Jones & Keffer's LaGrange 1, F. Rolen sur, lcn. Umburn & Jones' Bilhartz 1, F. Rolen sur, 1260 ft, dr.

BROOKS COUNTY—Cole Pet. Co. & Locke Purnell's G. D. Ullrich 1, Sec. 7, dr 4231 ft.

CALDWELL COUNTY—Anderson's W. B. Perry 1, G. Pace sur, sr 1740 ft. Kurz Oil Co.'s Kurz 1, Klecamp sur, dr 3573 ft. F. Meyers' Mooney 1, Seal sur, lcn. S. Smith's Copeland 1, Mebane Estate, move in machy.

CALHOUN COUNTY — Continental Oil Co.'s American Nat'l Realty Co. (Moody) 1, Sec. 6, blk C, dr 6655 ft. Southwest Oil Corp.'s Welder 1, J. M. Rios sur, dr 5850 ft. Steen Drlg. Co.'s Stanzel 1, A. Esparanza Grant, dr below 4100 ft.

DUVAL COUNTY — Continental Oil Co.'s Clara Driscoll Sevier 3-A, Sec. 23, td 3710 ft, pb 3350 ft, set csg, perf 3311-25 ft. Graham & Texon Royalty Co.'s Parr 2, Sec. 185, coring 3449 ft. Grimes et al's Fitzsimmons 1, Sec. 291,

sd after spudding. W. B. Stewart's J. Benavides 1, Sec. 355, dr 2310 ft. Smith & Jeffers Oil Co.'s Garcia 1, Hinojosa Grant, dr 4153 ft. Steren Oil Co.'s Phillip 1, Sec. 320, sp. Texas Co.'s Graham 1, Sec. 572, dr 5142 ft. Texas Co.'s Sutherland 1n, Sec. 503, sp.

EDWARDS COUNTY—H. Adams' Hollman 1, Sec. 22, dr 425 ft. Carter et al's W. A. Miers 1, Sec. 6, sd 415 ft. T. A. Ohlhausen's 1-B, Sec. 176, sd 495 ft. H. H. Sides' Turney 1, Sec. 164, sd 1010 ft, may pb and comp. in shallower sands.

FAYETTE COUNTY — Thomas & Texas Seaboard Oil Co.'s Glecker 1, Anna Powell League, dr 2700 ft.

FRIO COUNTY—Amerada Pet. Co.'s Halff & Oppenheimer 2, J. H. Gibson sur No. 16, sd for dr mud 8983 ft.

GOLIAD COUNTY—Jack Porter's Mrs. N. Meyer 1, L. Mott sur, re-dr below sur csg.

GONZALES COUNTY — H. H. Weinert's August Kallies 1, Nash sur, dr 3500 ft.

GUADALUPE COUNTY — Diamond Half Oil Co.'s Wm. Maierhofer 1, L. H. Peters sur, dr 1420 ft. L. E. Trout's McKee 1, Green DeWitt sur, sd 1200 ft.

HIDALGO COUNTY—Horne Butler's Dr. A. J. Austin Estate 1, 2 and 3, lcns made on Tarct 282, Por. 30, Moncrief and Showers, lcns made for John M. Lawrence 1, 2 and 3, Tract 274, Porcion 30, and Edinburg State Bank and Trust Co. 1, Tract 276, Por. 40. Tom Patton's Austin 1, Tract 282, Por. 39, lcn. Alamo Drlg. Co.'s Sullivan 1, Tract 283, Por. 89, sand 2769-80 ft, set csg, wocs. Alamo Drlg. Co.'s Sullivan 2, lcn; E. Flores 1, and 2, blk 266, Por. 38, lcn. Jack Clements, Felipe Faries 1, blk 273, Por. 39, lcn; F. B. Guerra 1, Tract 254, Por. 39, dk; F. B. Guerra 2, lcn. Danvers, Harrison & Davis' Austin 1, Share 282, lcn. Davis & Harrison's George 1, Por. 41, tract 13, td 4136 ft, sd 4136 ft. Evans' Lawrence 1, lcn. Heep Oil Corp.'s Y. de Flores 1, blk 284, coring 2750 ft; Seabury-George & Taylor 1, blk 254, Por. 38, coring 2710 ft. Luckey, Blocker & Bishop's F. B. Guerra 1, blk 254, Por. 39, dr 200 ft. McCullum Exploration Co.'s J. C. Enhelman 1, blk 79, Las Mastena Grant, move in rig. Moncrief & Showers' F. B. Guerra 1, blk 254, Share 39, sand 2757-65 ft, set csg, wocs. Union Sulphur Co.'s American Rio Grande Land & Irr. Co. 2, blk 86, lot 2080, N. Capisallo district, dr 6350 ft. Otto Woods' F. Guerra 1, Tract 254, Por. 39, dr 2630 ft; Guerra 2, dr below sur pipe 200 ft; Laurence 2, 3 and 4, prep to sp.

JACKSON COUNTY — Atkins & Neil's Hodges 1, blk 22, lcn.

JIM HOGG COUNTY — Van Rossum & Norwood's C. W. Hellen 1, Sec. 48, dr 1230 ft. J. M. Shugart's R. Golbein 1, Las Animas Grant, blk 55, sur 17, sp.

JIM WELLS COUNTY—Smith & Storey's Marth E. Dilworth 1, Sec. 88, Welsh sur, dr 3000 ft.

KARNES COUNTY—California Co.'s Toms 1, Barvo Grant, set 400 ft sur csg, wocs. F. P. Hynes' Swierez 1, Flores sur, dr 100 ft.

KERR COUNTY — Love & Eastland Oil Co.'s Love 5-E, Sec. 1593, dr 3100 ft. J. F. Morrisey Co.'s Karger 1, Sec. 1, dr 1150 ft.

LA SALLE COUNTY—Standard Oil Co. of DC's J. M. Martin 1, Sec. 683, sd 1550 ft.

LEE COUNTY—J. E. Pederson's C. A. Turner 1, D. Hudson sur, prep to run csg 6330 ft.

LIVE OAK COUNTY—H. Coquat's Jacobs 1, Everett & Henry sur, td 1826 ft, set whipstock 1790 ft, to sidetrack and re-core sand; Robertson 1, Dobie sur, dr 2300 ft; Little 1, Shipp sur, dr 1000 ft. Houston Oil Co.'s Cartwright 28, Colchado sur, dk. Lion Oil Ref. Co.'s McNeil 2, Jane Surry sur, dr 3600 ft.

McMULLEN COUNTY — Circle W. Oil Co.'s Wheeler 1, Sec. 44, dr 800 ft. E. W. Hopkins' H. L. Lark 1, blk 30, Scrugham sur, coring 980 ft. Whitfield's Jacob 1-A, Sec. 17, dr plugs 922 ft.

MEDINA COUNTY—Scoggins & Sanders' L. W. Burrell 1, Gage sur, dr 1800 ft. C. M. Peacock's Odem 1, Castro sur, sd 260 ft.

REAL COUNTY—M. J. Hartwell's Perry 1, Sec. 175, re-dr 2838 ft.

SAN PATRICIO COUNTY — Allied Minerals Co.'s Ramsel 1-A, Giddings sur, td 2000 ft, clean hole. Lonnie Glasscock's Timmons 1, blk 27, prep to sp. Gum Hollow Oil Co.'s Willacy 1, dr 3950 ft. Heep Oil Corp.'s Welder 4, Portillo sur, tested sand 6661 ft, show oil and sw, pb to re-test.

STARR COUNTY—Borah et al's A. Guerra 1, San Jose Grant, dr 1710 ft. C. L. Smith's Longfellow, sp and sd for water. Sun Oil Co.'s Gonzales & Clark 1, Sec. 372, dr 900 ft. United's Guerra 1, Por. 55, ru. Younkins et al's Kelsey Bass 1, blk 19, Por. 87, sand 1740-46 ft, prep dst.

TRAVIS COUNTY — Humble Oil & Ref. Co.'s Christian 1-B, Kemp sur, td 757 ft, completing.

UVALDE COUNTY—Word's Truelove 1-B, dr 1480 ft. Humble Oil & Ref. Co.'s Anderson 1, dr 4275 ft.

VICTORIA COUNTY — American Liberty Oil Co.'s A. Prybil 2, R. Manchola Grant, move in machy. Humble Oil & Ref. Co.'s A. M. McFaddin 2, dr 4190 ft. Plummer et al's Zimmer 1, Manchola Grant, coring for sand 4380 ft; E. Terrell 2, testing 2836 ft. Texas Co.'s A. M. McFaddin 2, dr 5500 ft; Midgett 1, T&NO sur, td 5790 ft, pb 2847 ft, completing as gas well.

WEBB COUNTY—W. W. Lincoln's M. B. Volpe 1, Sec. 2011, moving in. Cole Pet. Co.'s R. Benavides 86, Sec. 1, dr 3900 ft. Fidelity Exploration Co.'s R. Saldivar 1, Borrego Grant, Sec. 657, sd 2351 ft for repairs. W. P. Morris's A. M. Bruni 1, blk 65, Brown sub, Borrego Grant, sd 1385 ft. Starr State Oil Co.'s Yeager 11, Share 5, Las Animas Grant, coring 3025 ft. United Production Co. & Magnolia Pet. Co.'s V. Benavides 5, Arispe Grant, coring 3740 ft.

WILLIAMSON COUNTY—T. C. McConnell's J. R. Nazier 1, Zarzo sur, dr 750 ft. Stalle & Batts' A. J. Nelson 1, Lowe sur, dr 200 ft. Jackson et al's Bozarth 1, Miller sur, dr 1665 ft. J. M. Russell's Nelson Estate 1, Justive sur, dr 690 ft.

ZAPATA COUNTY—D. A. McAskill 1, Edwards sub Borrrego Grant, dr 125 ft. Danvers & Harrison's N. J. Vela 1, blk 7, Por. 29, sd 1602 ft. Merle Gunby's A. D. Haynes 3, Comitas & Villa Grants, blk 9, prep to sp. E. P. Well 1, Garcia 1, Pedernal sur, ru.

Sixth Producer Extends Louise

Houston.—The Louise field of Wharton County was extended 3000 feet to the north during the past week when Pure Oil Company completed K. P. Adams 1, 471 feet from the southeast and 467 feet from the northeast line of 706-acre tract in the T. W. Herd Survey, Section 26. This test was also the sixth producer for the field.

K. P. Adams 1 was completed for 74 barrels of 28.1 gravity oil daily through a quarter-inch choke with a tubing pressure of 1835 pounds and casing pressure of 283 pounds. Bottom of the hole is 5150 feet, with 9⅝-inch casing cemented at 5128 feet. On a recent drill stem test from 5126 to 5150 feet the well made 24 thribbles of oil through a quarter-inch choke in 27 minutes. No salt water is shown in the oil.

To the north of this field and centering around W.C. R.R. A-380 Survey, Rio Oil Company's block of 18,000 acres is reported to be taken over by Humble Oil & Refining Company. Rentals recently was paid on 8000 acres.

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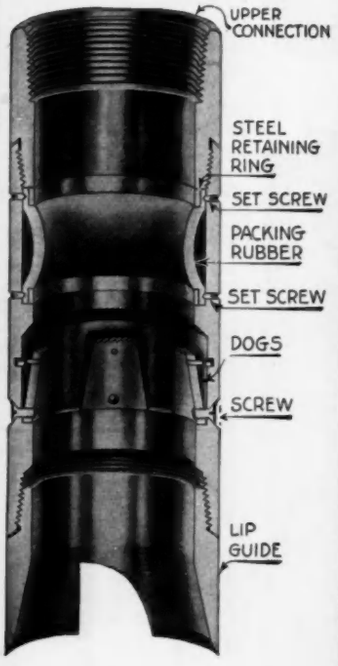

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Liquid Level Gauge

IMPERIAL INSTRUMENT, INC.

Imperial Instrument, Inc., Akron, Ohio, is offering a new type of liquid level gauge which works on the hydrostatic principle. The liquid in the tank is connected by means of copper tubing to a bellows type metal diaphragm which is linked mechanically to the indicator of the gauge. As the tank is filled, the diaphragm expands, the linkage moves the indicator, and the reading on the dial shows the exact quantity in terms of gallons or barrels.

New Machine Tongs

GEARENCH MANUFACTURING COMPANY

Gearench Manufacturing Company, Houston, is marketing the Petol machine tongs, designed especially for back-up jobs on pipe machines or pipe line work.

It features a positive, non-crushing grip, with assured ratcheting effect. It is equipped with a one-piece jaw, with replaceable inserts. Made of chrome nickel steel, this tongs is the lightest chain-type tongs made for the job. Sizes are for handling pipe of 1¼ inches to 22 inches.

Machine shops are using this tongs for breaking out tool joints from drill pipe, and collars from casing, due to the added strength built into this tool, according to the manufacturer.

Vacuum Switch

GENERAL ELECTRIC COMPANY

General Electric Company, Schenectady, New York, has announced a new small vacuum switch, made almost entirely of steel and designed to take advantage of the absence of an arc when breaking a circuit in a high vacuum. Although this new vacuum switch is only about three quarters of an inch in diameter and 1½ inches long, and can be operated by a fraction of an ounce of pressure, it is capable of interrupting as much as five horsepower as fast as 30 times a second, the manufacturer claims. Designated as the Type FA-6 vacuum switch, this new device is rated at 10 amperes, 250 volts d-c. and 440 volts a-c.—or five amperes at 500 volts d-c.

The G-E Type FA-6 vacuum switch is made of steel, hydro-

for the Oil Field

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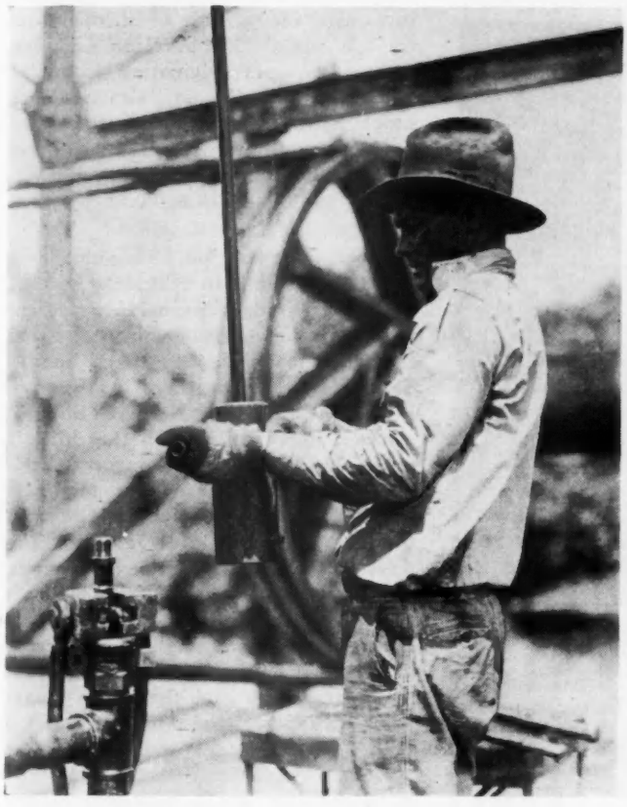
gen-copper-brazed and exhausted to a high vacuum through a hollow steel operating stem. This operating stem passes into the vacuum contact chamber through a thin steel end-wall whose flexibility permits the slight motion necessary for operation of the contact. The leading-in wires to the contacts are sealed in tiny glass beads inside small Fernico alloy thimbles.

Sucker Rod Box Cleaner

JARECKI MANUFACTURING COMPANY

Jarecki Manufacturing Company, Tulsa, Oklahoma, has announced the Jarecki-Collins Sucker Rod Box Cleaner, a device for removing dirt, sand and gritty material from sucker rod boxes and couplings.



Jarecki-Collins Sucker Rod Box Cleaner

The cleaner is used when the rods are being run into the well. With the rod or stand of rods suspended in the derrick, the box or coupling is guided into the funnel of the cleaner, and the cleaner raised and lowered under the rod three or four times. This movement causes the plunger in the cleaner to be forced downward and the fluid to be jetted against the threads with considerable force. Repeating the operation several times insures thorough washing of the threads.

The cleaning fluid should consist of lubricating oil thinned with kerosene, but when only a lubricating effect is desired, the fluid may consist entirely of engine oil. Complete information is given in Bulletin No. 2, which will be mailed upon request.

Exterior of 27,000 sq. ft. plant. Insets (left to right) Geo. E. Bryant, Jr., Vice-Pres.; Geo. E. Bryant, Sr., Pres. and Gen. Mgr., and B. D. Todd, Office Mgr.

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Line-up of part of the shop crew

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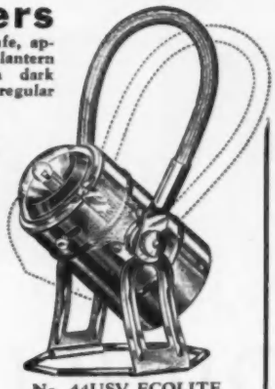

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NEWS *from the* *Industry's* EQUIPMENT MAKERS

Elmer Smith to Houston For Lane-Wells Company

Elmer R. Smith, of Lane-Wells Company, Los Angeles, has been transferred to Houston, Texas, where he will take charge of the service and sales of the company in the Gulf Coast, Texas and Mid-Continent territory. The branch office recently opened by Lane-Wells Company in Houston is located at 1315 Palmer Street and is equipped to provide gun perforator and magnetic fishing service as well as packers, liner hangers and other products of the company.

ELMER R. SMITH

After four years with the engineering department of one of the major oil companies in California and three years with Martin-Decker Corporation, Mr. Smith has spent the past year with Lane-Wells Company, where he has had extensive experience in the operation of the gun perforator. As manager of the Houston branch, he will be in active charge of this perforating service. Coming from a family that has been connected with the oil industry for the last 30 years, his experience in oil field operations has been extensive and ably fits him for directing the Lane-Wells operations in his new territory.

Axelson Official to Make South American Survey

Undertaking an itinerary which will include every oil producing country in South America, A. G. Haglund, vice president and works manager of the Axelson Manufacturing Company, left Miami, Florida, October 7, via plane, for Maracaibo, Venezuela.

Mr. Haglund's trip will cover a three to four months period, notwithstanding that wherever possible he will utilize the airplane for transportation. According to J. C. Axelson, president of the Axelson organization, the trip has been planned with the idea of offering suggestions and solutions to the production problems with which operators are confronted. Mr. Axelson said, numerous requests originating from the officials of the oil companies in South America for information on the latest products and improvements have necessitated sending a representative direct to the oil fields to make personal contacts.

At Maracaibo Mr. Haglund will spend one month in company with C. C. McDermond, Venezuelan representative for the Axelson concern. From Maracaibo the itinerary takes him to Colombia, and from there to Trinidad, British West Indies, where he will work in cooperation with the officials of C. Tennant Sons & Company, Axelson representatives in that territory. From Trinidad Mr. Haglund goes to Buenos Aires via Rio de Janeiro. The Axelson representative in the Argentine territory, John R. Webb, will assist in the work in that country. From Buenos Aires Mr. Haglund will cross to the Pacific Coast via Santiago, north to Talara, Peru and thence to Guayaquil, Ecuador.

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Teacher: "This essay on 'Our Cat' is exactly, word for word, the same as your brother's."

Arthur: "Yes, miss; it's the same cat."

Mr. Smathers: "Mose, can you explain wireless telegraphy to me?"

Mose: "Yessuh, it lak dis: Ef yo' all had a long, long houn' dawg, an' he stretched from Cincinnaty to Pittsbu'g, an' yo' stept on his tail in Cincinnaty, he would howl in Pittsbu'g. Dat am telegraphy. Only in wiahless, yo' does de same thing without de dawg."

"How did you get sleeping sickness—ever been in the tropics?"

"No, but in the civil service."

Why did you tip that girl so much when she gave you your coat?

Look at the coat she gave me.

"Young man," said the boss, pompously and pointedly, "what we need in this business is brains—b-r-a-i-n-s—brains."

"Well," agreed the youthful applicant for a job, "that does seem to be about what is lacking."

A Scotchman, an Englishman and an Irishman were on a raft in the middle of the ocean. There was no hope of rescue, so the Irishman, a very pious man, got on his knees to pray. The Englishman, out of respect for the Irishman, took off his hat. The Scotchman thought that the Englishmen was going to pass the hat, and dived overboard.

Personal appearance is a helpful factor in business success.

Yes, and business success is a helpful factor in personal appearance.

When Tommy handed in his home work, the teacher examined it very closely. "That looks suspiciously like your father's handwriting, Tommy," he said. "What have you got to say?"

"Well, sir," replied Tommy after a long pause, "now I come to think of it, I used his fountain pen."

Employer (to applicant for job)—Can you write shorthand?

Applicant—Yes, sir; but it takes me longer.

"A moth leads an awful life."

"How come?"

"He spends the summer in a fur coat and the winter in a bathing suit."

When a baby gnu was born in the San Francisco zoo, George Bistany, the superintendent, called up the city editor of a local paper to report it. The city editor understood Bistany to say: "We have some news about the news."

"Do you mean it's new news?" asked the city editor.

"Yes," replied Bistany, "new news about the new gnu."

"But all news is new."

"Oh, we have some old gnus here, but I want to give you some new gnu news about the new gnu that our old gnus have."

"Will you please," pleaded the city editor, "write it and send it in?"

Bistany did, and his note said: "I was trying to give you some gnu news about our two old gnus that have a baby gnu. Both the old gnus and the new gnu are doing very well."

"What's a joint account, pop?"

"It's an account where one person does the depositing and the other the withdrawing."

Hotel Clerk—Inside or outside room, sir?

Guest—Inside, I guess. It looks like rain.

"Jane," cried the mistress, reproachfully, "you informed me a while ago that you were going to have a little sleep."

"Yes, Madam," replied the maid.

"Then," paused her mistress, "what were you doing at the garden gate when the soldiers passed by?"

"Having 40 winks," answered the maid, unabashed.

Lawyer—Did you see the automobile approaching the railroad track?

Crossing watchman—Yes, and I said, "That is a nice car—wasn't it?"

Judge—But if you were doing no wrong, why did you run when the officer approached you?

Prisoner—I thought he wanted to try and sell me a ticket for the Police Circus.

Percival—That was the unkindest cut of all, as the poet says.

Penelope—What was?

Percival—I showed her one of my boyhood pictures with my father holding me on his knee and she said, "My, who is the ventriloquist?"

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Authorized Appleman Bit Service
Axelson Manufacturing Co. 81

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Broderick & Bascom Rope Co.
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Cameron Iron Works 86
C. L. Carlock 88
Caterpillar Tractor Co.
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Chemical Process Corp.
Climax Engineering Co.
Continental Supply Co. Insert, 42-43
Fred E. Cooper Co.
Cooper Bessemer Corp. Second Cover
The Corbett Corp.
W. H. Curtin & Co. 74
Corpus Christi National Bank
Cowan Machine Shop

Darling Valve & Mfg. Co.
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DeWitt Operated Hotels
Diamond Metal Co.

H. John Eastman
E. H. Edwards Co.
Economy Electric Lantern Co. 88
Geo. H. Echols
Elliott Core Drilling Co.
Emsco Derrick & Equipment Co.
Emsco-Falk

Geo. E. Failing Supply Co.
Fairbanks Morse Co.
Farrar & Trefts Insert, 42-43
Fenwick-Reddaway Manufacturing Co.
Ford Motor Co.
Fort Worth Laboratories 88
Frick-Reid Supply Co.

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H. P. Gott Manufacturing Co.
B. F. Goodrich Rubber Co. 20-21
Gray Tool Co. 85
Gray-Kerotest
The Guiberson Corp.
Gulf Publishing Co. 15
Gulf States Utilities Co. 73

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Hamilton Brothers
Hardway & Cathey 88
Haynes Stellite Co.
Hazard Wire Rope Co.
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Hercules Motors Corp. 4
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Hughes Tool Co. Back Cover
Humble Oil & Refining Co.
Hyatt Roller Bearing Co.

Independent Exploration Co. 88
Ingersoll-Rand Co.
International Cement Corp.
International Derrick & Equipment Co.
International Harvester Co.
International Nickel Co. 63

Byron Jackson Co.
Jarecki Manufacturing Co.
W. P. Jenny
Jensen Brothers Manufacturing Co.
S. M. Jones Co.
Jones & Laughlin Steel Corp.

Kobe, Inc.
Kerotest Manufacturing Co. 54

Larkin Packer Co. 67
Layne & Bowler Co.
The Lane Wells Co.
Link Belt Co.
Ludlow Valve Manufacturing Co. 76
Lufkin Foundry & Machine Co.

MacClatchie Manufacturing Co.
Maloney Tank Mfg. Co.
Martin-Decker Corp.
F. G. Masquelette & Co.
J. H. McEvoy & Co.
Mechanical Rubber Co.
Mengden & Sons Co.
Geo. S. Mepham Co. 71
Merchants Photo Service
Merco Nordstrom Valve Co.
Milam Drilling Co.
Miller Sand Pump Co.
Mission Manufacturing Co.
Lee C. Moore & Co. 55
Muskogee Iron Works

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Oil Center Tool Co.
Oil City Brass Works. 87
The Oil Well Improvements Co.
Oklahoma Gas & Electric Co.
Operation Engineers, Inc. 88
Osage Metal Co.
Oster-Williams

The Parkersburg Rig & Reel Co.
Pelican Well Tool & Supply Co. 89
Hotel Pennsylvania 88
Petroleum Iron Works
Petroleum Rectifying Co.
Pittsburgh Equitable Meter Co.
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Portable Rig Co.

Reed Roller Bit Co.
Republic Portland Cement Co. 18
Republic Steel Corp.
The Republic Rubber Co.
Ridge Tool Co.
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San Antonio Machine & Supply Co.
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Second National Bank
Seismograph Service Corp.
Separafine Chemical Sales Co.
Shaffer Tool Works
Shell Union Oil Corp. 57
SKF Industries, Inc.
South Chester Tube Co. Third Cover
Southern Pacific Lines
Southwestern Machine & Supply Co.
Howard Smith Co.
E. M. Smith Co.
Sperry-Sun Well Surveying Co. 28
State Bit Co.
Jesse R. Stone and Lester B. Clark 88

Texas Electric Service Co.
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